ELECTRICAL REVIEW

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Improving the Service

Attempted Co-ordination of Views

RECENT proposals for the reorganisation of the electricity supply industry have frankly been of a partisan nature. In view of the need for unity and for avoiding an upheaval in what is, after all, quite an efficient service, the publication of these discordant opinions was to be deplored. This reference to "efficient service" does not mean that everything is for the best in the best of all possible industries. All the reports have recognised that there are shortcomings in some directions which must be remedied if electricity supply is to approach perfection.

Measure of Agreement

Whether the latest report on the subject will be acceptable to the Government remains to be seen, but it is at least an attempt to co-ordinate the views of the two principal parties—the local authorities and the company undertakings. This report, produced by the Joint Committee of Electricity Supply Associations, minus the official representatives of the Power Companies' Association, deals with policy and practice. So far as the latter is concerned there is little difference between the two classes of owners. The industry is already agreed that there should be uniformity of systems and voltages, that there should be some standardisation of appliances, that the service should be available in rural areas and that a more uniform system of charging is desirable.

Rural electrification appears to be the real question behind most of the recent political agitation. On this subject the report agrees with earlier reports that while rural service can be subsidised to some extent by urban consumers, there is a limit beyond which some form of financial assistance from outside becomes necessary.

When the future organisation of the industry is considered it must be remembered, as the report says, that "supplying electricity is a dynamic business enterprise which, by means of highly technical engineering processes and up-to-date commercial methods, already brings an important commodity into some ten million homes and factories in this country." In other words, it is doubtful whether benefit could be derived from State ownership and control with all that that implies. Personal contact between the suppliers and the consumers is essential as is flexibility of control. On-the-spot decisions must be made; too-rigid adherence to fixed rules will not do.

Number and Efficiency

This consideration of the "local touch" leads to the conclusion that a drastic reduction in the number of undertakings would not necessarily lead to lower prices or more efficient service. At the same time it is recognised that entirely independent operation is undesirable—that there should be greater co-operation between the units of the industry. Accordingly it is recommended that the country should be divided up into areas determined by the Electricity Commissioners guided by an Advisory Committee. Each of these would

have a Committee, appointed by the authorised undertakers of the area, whose duties would be to recommend to the Commissioners plans for securing economy and improvement in electricity supply. A sixteen-point programme is laid down. Recommendations approved by the Commissioners would become binding upon all undertakings except where amalgamation or acquisition of undertakings without the consent of the parties concerned was involved. In such a case the matter would be decided on its merits by the Minister of Fuel and Power with the approval of Parliament. This would mean much additional work for the Electricity Commission (all reorganisation schemes do) and so again the strengthening of the Commission is recommended. It will be seen that the scheme relies largely upon the goodwill of the industry. Is this sufficiently strong to bring about the necessary improvements or must it be left to external forces?

I.E.E. Report

THE technical aspects of post-war electrical development are comprehensively dealt with in the report of the I.E.E. Sub-Committee on Electricity Supply, Distribution and Installation which is reviewed in this issue. A thorough survey, slightly limited by the absence of up-to-date statistics, is made of the position with regard to systems and voltages and estimates of the cost of national standardisation are made. The Sub-Committee deals with the factors governing rural supply and comes to the conclusion reached by most electrical authorities that, while much more can be done to take electricity to villages, the remoter farms and houses can only be brought in if some form of financial assistance is given. On the subject of charges, the Sub-Committee advocates separate attention to four groups of consumers and for domestic purposes favours the floor-area basis for two-part tariffs, with a variable-block system as a good alternative.

Installation

ONE of the most interesting and useful sections of the report is that referring to the future of installation work. It is recognised that the accretions to the Wiring Regulations since these were drawn up sixty years ago have made a radical revision desirable. The Sub-Committee proposes that there should be separate "Basic Safety Regulations" (with a "Code of Practical Interpretation") and supporting "Codes of Good Practice." The compulsory registration of contractors and operatives is held not to be justified by the circumstances. This also applies to compulsory regulations, although here it is thought that if those concerned agreed that such a course was necessary, the proposed Basic Safety Regulations would probably meet the requirements.

A Man's Job

A GOOD idea of the wide range covered by the duties and responsibilities of the chief engineer of a large electricity supply undertaking was conveyed in a paper presented last Wednesday before the Midland Section of the Junior Institution of Engineers by Mr. F. W. Lawton, the new chief engineer and manager of the Birmingham Electric Supply Department. His object was to indicate to aspirants to positions in the electricity supply industry the nature and scope of the business. Some of Mr. Lawton's hearers may have been dismayed by the survey, but among them, perhaps, were one or two who have made up their minds to fit themselves for the exacting task and to take their places among the "chiefs" of the future.

Copper Situation

AN easing of the copper supply position was indicated in the article on "Electrical Materials" which appeared in our issue of January 14th, when it was suggested that there would probably be a lightening of the restrictions upon consumption. However that may be, it seems that action is being taken at the other end for the Colonial Office announced last week that the British Government had decided to reduce its purchases of Northern Rhodesian copper to the extent of between 20 and 25 per cent. of the 1943 production.

Too Much Control

WE have already reported the perturbation aroused in the electricity supply industry by the possibilities inherent in the Town and Country Planning Act, 1943. This measure not only gives the Minister of Town and Country Planning a say in the erection of buildings and equipment for the supply of electricity, it seems to empower him to order the removal of these in certain circumstances. This is in spite of the

fact that undertakings have already to gain the approval of appropriate bodies before proceeding with the work. The subject is treated at length in a report by the General Purposes Committee of the London J.E.A., which considers that agreement could be reached between the Ministry, other departments concerned, and the electricity supply industry by which control could be exercised by the Ministry of Fuel and Power and the Electricity Commissioners. The Committee thinks that, rather than seeking to impose further control, the Planning Ministry should look to the industry to take an active and essential part in planning schemes.

Unwanted Suggestions

THROUGH some ambiguity in two contiguous sentences in the January *I.M.E.A. Journal* we concluded that the reconstructed Joint Committee of Electricity Supply Associations was asking for suggestions for a new title. We said so, with the result that the Committee has been overwhelmed with letters on the subject. Now we are told that this was not an invitation and are requested to ask readers to desist.

I.E.E. Groups

THE formation of a third Wireless Group within twelve months by the Institution of Electrical Engineers, as announced in this issue, indicates that the movement towards sectionalising well-defined spheres fulfils a need. It also indicates the adaptability of the organisation in providing for discussions among members of matters of specialised interests as these come to the fore. The new Group covers Cambridge and District and represents in one way a departure from precedent, in that it is an extra-London body that is unattached to a local centre or sub-centre. The composition of its provisional committee being about equally proportioned among academic and industrial interests should ensure that both of these aspects receive due attention.

A New Grid ?

A " big expansion of the grid system " has been discovered by the *Farmers Weekly*, which suggests that practically the whole of rural Britain might be supplied with power and heat from a similar source. The " grid " in this case, however, consists of some pipes interconnecting small gas-holders and tapped on the way. Wiltshire is said to have benefited more than most areas, as instanced by six bulk supplies from Swindon. An increase of 1·2 cu. ft. in ten years (equal to approximately 150,000 kWh) makes the simile of " a giant spider's web," as used by our contemporary for such local enterprise, a little unfortunate, having regard to the negative moral of the nursery rhyme and to the positive achievements of electricity undertakings serving the countryside.

Romance and Reality

MORE than economics or social considerations of a materialistic nature are seemingly involved in railway electrification. A contributor to a provincial daily recently regretted the decline in the number of steam locomotives operating just before the war. Although his liking for steam locomotives " that trail smoke and steam " as contrasted with the " dullness " of their electric successors may be conservative, it cannot be termed pre-Victorian, since it was those characteristics that aroused the opposition of our ancestors to early railroad projects. Perhaps one need not be regarded as very old-fashioned for objecting to their manifestations in Princes Street, Edinburgh, or, indeed, in any cities where human beings must live and breathe.

Traction Motors

Two ways of reducing the weight of electric railway coaches, with a view to economy in energy consumption, are future probabilities. The standard motor can be of welded construction or a machine of the trolley-bus type can be employed. In regard to the first, Mr. W. J. A. Sykes of the Southern Railway mentioned a pre-war Continental design in which the weight had been reduced from the usual 30 lb. or so per HP to 14 lb. The high speed of the trolley-bus motor would enable its weight to be cut to about 12 lb. per HP. Some additional maintenance cost in the latter case, due to the use of double-reduction gear, would no doubt be offset by a somewhat higher electrical efficiency. The lighter motors would entail the use of lighter bogeys, in this way considerably adding to the overall effect.

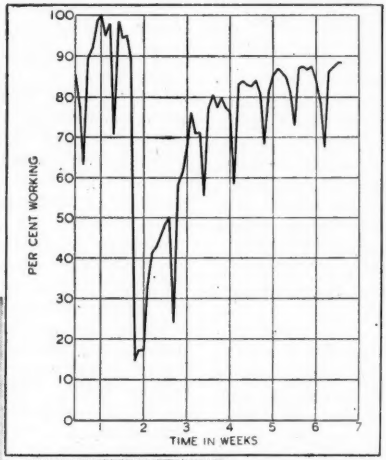
Electricity in Wartime—II

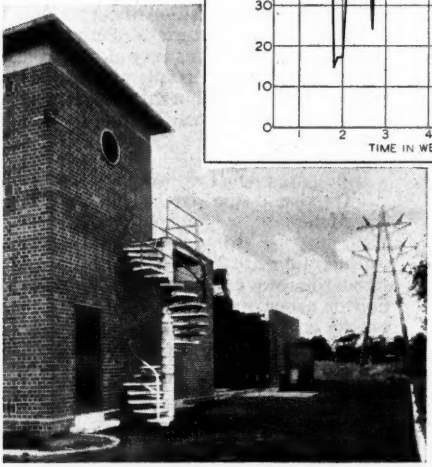
Flexibility of Supply Demonstrated

AFTER all that has happened during the past four years by way of upsetting the smooth working of electricity supply distribution—overloading, supply dispersal, air-raid damage, and the rest—it is surprising to find that, in principle and practice, the ideas on which development has taken place remain unaltered, apart from various modifications to meet emergency conditions. For instance, 33-kV cables have been laid in gutters to afford quick restoration of supplies after heavy air raids. Very few consumers in a position to take it have been left without a supply, even after the heaviest raids.

Some of the earliest difficulties resulted from the dispersal of factories from the dense city and town districts to outer suburban or rural areas, involving special network extensions and often extensions to, say, 33-kV transmission systems. Side by side with such dispersal there have been extraordinary cases of overloading such as, for example, the maintenance of 8,000 kVA on a 5,000-kVA transformer by installing a pump and playing water continuously on to the equipment. Occasions also arise when shedding of load is necessary, and interruptions of twenty minutes' duration or more are a serious matter for small but scattered consumers who rely on electricity for heating in special processes. It seems desirable to interrupt the supply to many for short intervals rather than to few consumers for long periods in these special emergencies.

It should be emphasised, however, that by far the greatest achievement in regard to distribution is in coping with rapid wartime load building rather than dealing with emergencies. New system extensions have been established, both underground and overhead, and new substations have been erected purely in consequence of war production demands and as part of the foundational systems already established. In this respect the new primary 33-kV substations described in the *Electrical Review* of October 15th, 1943, may be mentioned. New processes required for war production have involved the installation of special plant, and a large number of consumers who were in receipt of low-voltage DC supplies only have had to be supplied with AC; in consequence, low-voltage AC extensions have penetrated into DC supply areas of cities and towns.

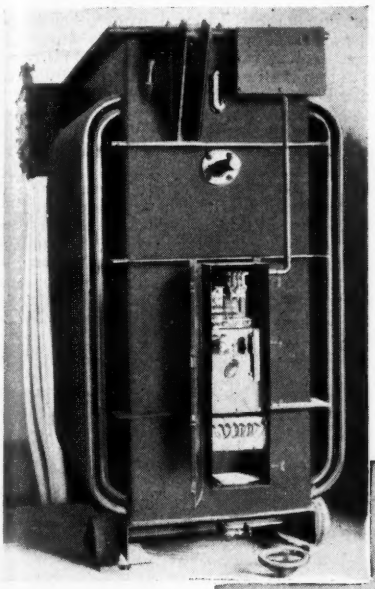




One of the most remarkable features of the supply undertakings' war effort has been the rapid recovery of load after its loss as the result of air-raid damage. The diagram shows a load curve of one undertaking, suitably modified
New system extensions have been established purely in consequence of war-production demands. Left: New 33-kV substation on special wartime extension

In contrast with this there are normal peacetime development schemes involving change-over from DC to AC which have been interrupted for the duration. Similarly, much normal maintenance work on distribution systems is being held up, but it is pleasing to learn that special financial arrangements are

being made now so that much work of this kind can be put in hand as a matter of urgency as soon as conditions permit. Measured in terms of both system capacities and physical

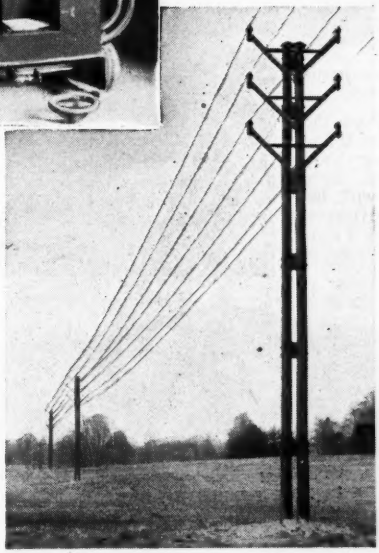


difficulties, however, we should say that the achievements in greater utilisation of existing systems and equipment outweigh those relating to extensions. Both e.h.v. and h.v. systems are being utilised to their maximum capacities—and sometimes more, apart from the emergency overloading to which we have already referred—and the amount of spare cable and transformer capacity available for stand-by has been reduced to a minimum.

In this connection the benefit of increases in primary system voltage effected by some undertakings in the few years before the war has been particularly felt, and one undertaking which increased its system voltage to 11,000 writes: "It has been possible to deal with a considerable increase of load on the e.h.v. distribution system during the war by carrying out very moderate extensions to the system." With all the load irregularities consequent on the severe wartime conditions, voltage-regulation difficulties have, of course, been very marked, and the way in which they have been eased and overcome is praiseworthy. This work has often entailed the transfer, in many cases with extreme urgency, of transformers from lighter- to heavier-loaded sections of systems, and *vice versa*, and such efforts, with the indulgence of consumers, have resulted in general satisfaction.

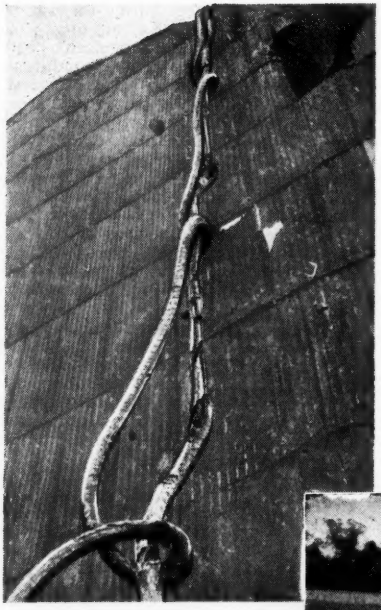
A voltage-regulator development which has given excellent results on a rather widely dispersed bulk supply overhead network is the Ferranti combined transformer and regulator. It has a common housing and is fully automatic, and the supply engineer in this case described it as the transformer of the future. The increased use of electric welders and furnaces has introduced voltage-regulation difficulties on many networks, and fitting automatic on-load tap-changing to the main transformers has often been the solution.

Left: A voltage-regulator development which has given excellent results is the combined transformer and regulator which has been described as the "transformer of the future." An excellent example of overhead distribution system reinforcements to meet load growth is the Rutter-line scheme (below)



Generally overhead line distribution difficulties have not been so severe as those in connection with underground cable distribution. There have been many cases of overloading, however, and one excellent example of a system reinforcement to meet load growth is the Rutter-line scheme described in the *Electrical Review* of May 21st, 1943. Among the most interesting work relating to normal overhead distribution has been the large-scale replacement of some overhead lines by underground cables in the vicinities of aerodromes; the cable plough has been used to speed up this work.

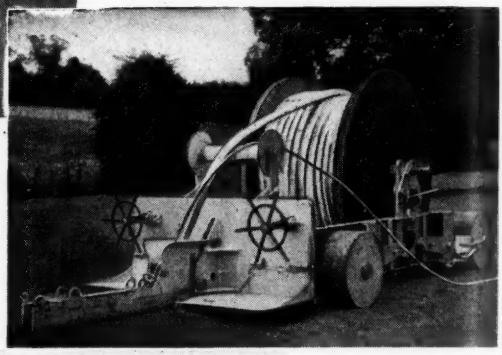
While the greatly increased areas of cultivated land to-day have made it more difficult to establish suitable routes for new overhead lines, this difficulty seems to have been more than offset by the fewer objections from land-

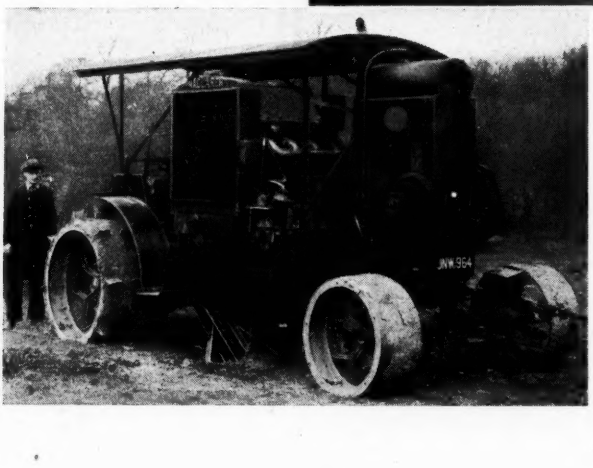


Blast effect; this cable was originally on a drum in the yard

owners and farmers from the amenity viewpoint; indeed, one engineer told us that everybody concerned is now much more helpful in connection with his efforts to obtain wayleaves. Another direction in which war-time exigencies have resulted in a more helpful attitude on the part of the public is in connection with consumers' sub-stations. Consumers connected to an e.h.v. system have now had their attention directed to the vital importance of the substation and its switchgear and transformers. New brick-built substations isolated from other build-ings and having substantial roofs which will keep out water and incendiaries are far easier to obtain than formerly. Pre-war substations have been altered by strengthening the walls (sometimes, unfortunately, on the inside, so restricting the inside space) and by bricking up windows and erecting new replacement or additional roofs. An interesting observation is that blast walls in front of doors and gear are no doubt useful in emergency, but they often introduce risks which would not be tolerated in more normal times. Overheating difficulties have arisen as the result of enclos-ing transformers in brickwork, and in some quarters the pit below the transformer is favoured as a means of dealing with oil leakage.

Sufficient attention is not always paid to the ventilation of consumers' substations, and maybe overheating troubles, which are not usually shown for some time, are being post-dated in conse-quence. Some consumers, having pro-vided themselves with well-built substations, lose no time in using these for storing im-portant and valuable tools and material which certainly should

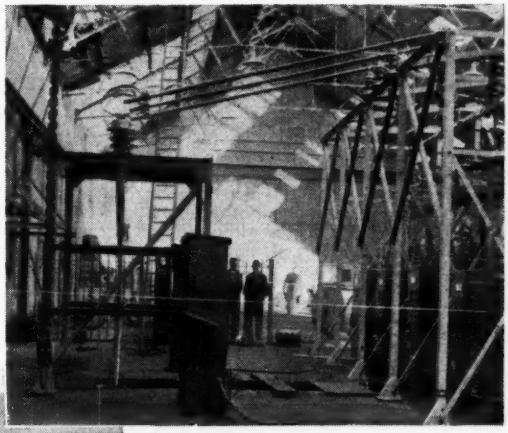


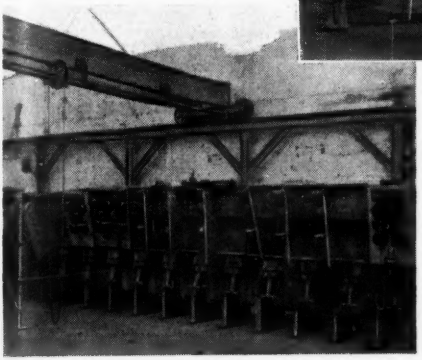


Good use has been made of the cable plough in meeting emergency work; windlass and plough

not be found in a substation. Inspection of consumers' switchgear presents some difficulties in view of the shift-working of factories, and much time is wasted in negotiating with firms for permission to cut supplies off for inspection purposes, even for short periods.

One of the most remarkable features of the supply undertakings' war effort has been the rapid recovery of load after its loss as the result of air-raid damage and the destruction of substations, switchgear, transformers and cables. There appear to be three main contributions to this brighter aspect. Firstly, there is the demonstration of "flexibility of supply" to which we have already referred, namely, the running out of extra-high-voltage cables unprotected on the ground surface to transfer great blocks of load quickly from one sector to another; restoration of supply is also facilitated by the layout of e.h.v. and l.v. networks in that, by the judicious use of linking points, easy transference of load from one section to another has been possible. Secondly, great help has been afforded by the special organisations set up by the undertakings to deal with emergency conditions: to cite one instance, a special organisation of emergency staff deals with air-raid damage, while a special mains department control centre deals with incidents in conjunction with the generating station control engineers and the substation shift engineers. Last, but not least, there is the "all-out" endeavour, bravery and devotion to duty with which the staff and operatives have faced the task.





The national pool of switchgear and transformers has been invaluable in restoring supplies; the photographs show 6·6-kV metal-clad substation switchboard destroyed by fire and a replacement 6·6-kV outdoor-type switchgear which was installed in three days

After some of the heavy raids large numbers of services have had to be cut and bottle-ended, and joints made on both e.h.v. and l.v. mains, and it is an extraordinary fact that in the case of one undertaking, only one cold-filling temporary joint was affected out of some hundreds of joints that were made. It has been found that the work on t.l.s. cable is much speedier than that on

A wrecked substation

belted cable, because three jointers can work on the former at one time. The establishment of special emergency stocks of cable, joint boxes, etc., has been invaluable in carrying out distribution repairs.

Ground subsidences and excavations by other public services have often caused further distribution-system faults, and to overcome such difficulties one undertaking has organised a system of frequent routine pressure testing. Post-raid deterioration of properties and the movement of tenants from partially damaged premises without notification have caused special difficulties, and arrangements have had to be made with various departments of the local authority and the Ministry of Works for the notification of properties to be demolished, etc.

Occasions have arisen when the roofs of substations have been blasted off and switching operations have been carried out, pending repairs, by the light of a torch. Sometimes snow and rain have fallen before even temporary repairs could be effected, but the machines have continued to run with nothing but a tarpaulin as cover. There are cases of load recovery by the installation of switchgear and transformers under tarpaulins to replace completely destroyed substations, while Anderson shelters have been used for small temporary substations.

The National Pool

It is pleasing to learn that there has been comparatively little requisitioning of switchgear and transformers from the national "pool," but in the few cases where this has been necessary it has been invaluable in restoring power supplies, and the foresight of those responsible for the scheme has been marked by the success achieved. The engineers who have received assistance from the national pool have acknowledged it in high terms of praise. The greatest difficulty in this connection appears to have been the poor delivery of new switchgear to replace the pool equipment which, in one case, was in commission for eighteen months. The E.D.A. mutual-aid schemes by which undertakings in certain areas have been able to make demands on one another for emergency equipment by the exchange of lists of stocks has also been proved a great success, as have the pooling schemes adopted by individual undertakings with regard to consumers' transformers, etc. Similarly, mutual aid by the supply of skilled labour, particularly cable jointers, has contributed to the rapid restoration of load, and in this connection the cable manufacturers have helped considerably.

Difficulties have also been encountered in carrying out mains constructional work generally as the result of the shortage of labourers and special arrangements have been made in some cases to obtain them from Ireland, to transfer labour from public works contractors and various departments of local authorities, and to use, in certain cases, members of the Services. The labour problem has been aggravated by the necessity to "lend" certain skilled men to the Ministries and other bodies, and by the non-proficiency of "new" labour. The good work of women is evident on the distribution side, particularly in connection with battery maintenance and substation cleaning, and an interesting observation from one quarter is that the women work better alone or in groups—not in pairs—for perfect harmony.

Shortages of materials have set the distribution engineer many problems which he has tackled with much success. To save steel, unarmoured cables have had to be adopted generally, with special supervision in laying them. The use of English and Scottish firs and larches for overhead-line poles is an experiment which is being keenly watched, while special measures to save poles, such as the use, where possible, of G.P.O. telephone-line poles, has also contributed to the solution of many difficulties. Much has also been done by the recovery from the ground of disused cables and joint boxes.

An interesting materials-shortage problem relates to the supply of DC electro-graphite brushes for motors and rotary convertors. The new brushes will not always run satisfactorily with the old ones, and it has been necessary to fit a machine with all new brushes. Lack of transport is another difficulty and here the bicycle has come into its own again for visiting outlying substations, etc.

Finally, the distribution engineer is keenly interested in the future in connection with his reconstruction work. He is much handicapped by lack of information at this stage, of course, and is perturbed by one thought in particular: do the re-planners of the cities realise what vast amounts of money are represented by the cables and services under the streets?

County of London Plan

THE General Purposes Committee of the London and Home Counties J.E.A. has considered the "County of London Plan" issued by the County Council and finds that the carrying out of the proposals would necessitate substantial alterations in the lay-out and operation of the pipes, lines and other works of such public utilities as electricity, gas and water. At the same time, adequate provision of these services must form an essential part of the plan. It is suggested that consultations should take place at the appropriate time between the responsible authorities with a view to securing that the electricity supply services in the area should not be unduly prejudiced and that these services should afford the greatest possible assistance in making available adequate electricity supplies for all purposes such as domestic consumption, industrial use, transport, street lighting, etc.

Electricity Distribution

Memorandum of Joint Committee

LAST June the Ministry of Fuel and Power suggested to the Electricity Commissioners that the electricity industry should be invited to consider questions affecting its future. The suggestion arose out of a statement by Lord Portal, then Minister of Works and Planning, that the Paymaster-General was looking into the matter of electricity and would report in due course to the Ministry of Fuel and Power. He was examining the reorganisation question from the following main points of view:—To secure a better diversity of load, and a greater standardisation of voltage; to work towards a uniformity of charge throughout the country; to adopt a common policy with regard to development; and to put the best engineering advice at the disposal of all distributors.

Mr. J. W. J. Townley is now chairman of the Joint Committee

With a view to dealing with these points a memorandum has been prepared by the Incorporated Municipal Electrical Association; the Provincial Electric Supply Association; the London Electricity Supply Association; and a group of power companies, which are members of the Incorporated Association of Electric Power Companies.

In a reference to the McGowan Report it is recalled that although that Committee's recommendations had been accepted in principle by the Government they had met with opposition from a large part of the industry. The proposals would have led to considerable and unnecessary dislocation and a recession of the goodwill and efficiency upon which the industry had been built and fostered. This seems to have been recognised by the Government and no steps were taken to implement the Committee's recommendations. The war and consequent changes in national outlook have focused attention on the possible need for reorganisation, but the memorandum says that while it is recognised that further development must take place and changes be made, it is assumed that change for the sake of change is no part of the national plan.

Therefore the memorandum recommends changes only where they are necessary to improve service to consumers and it has been taken as axiomatic that subject to any over-riding considerations of national policy, industrial and domestic consumers shall have a free right of choice as to the fuel service they wish to employ; and unless it can be proved that consumers will derive substantial and permanent benefit thereby the ownership and organisation of existing undertakings shall not be subject to drastic alteration.

Part I of the memorandum contains a brief historical survey and mentions the parts played by the British Electrical Development Association and the Electrical Research Association. It is considered that the Electricity Commissioners' contribution to development would have been greater if the full powers given to them by the 1919 Electricity (Supply) Act had been exercised. Treasury control of the appointment and remuneration of the Commission's staff is held to have had a restrictive effect.

It is shown that in the last published returns of the Electricity Commissioners there were 377 public authority undertakings with 59·69 per cent. of the total capital expenditure of £553·5 millions and 63·1 per cent. of the energy sold (19·202 million kWh). Corresponding figures for the companies were 214, 40·31 per cent. and 36·9 per cent. Diagrams are appended to the memorandum to show the progress of the industry under this mixed ownership. These indicate that in sixteen years capital expenditure has increased 3·85 times, the energy sold 6·15 times and the average price per kWh has been reduced by three-fifths of the initial price; the number of consumers has risen 3·6 times in ten years.

Before the war the industry employed 100,000 workers whose remuneration and conditions of service compared favourably with those of any other basic industry. This has been proved by the absence of serious industrial disputes during the past twenty years.

Mention is made of the fact that holding companies were dealt with at length by the McGowan Committee and that inquiries into the general question by a Committee under Lord Sankey had come to an end shortly before the war.

Faults and Remedies

The second part of the memorandum is concerned with certain criticisms made by consumers and suggests methods of meeting them. It is thought that greater uniformity of tariffs would be possible if there were much more uniformity of bulk supply charges. But even so it would still not be possible, or even desirable, for charges to be the same in all parts of the country and for all purposes. Regard must be had to economic factors,

local conditions and to the need for encouraging certain types of load in the national interest. There must be elasticity in the framing of industrial tariffs. As regards domestic supplies, however, it is considered desirable that in addition to the statutory flat rate system of charging there should be a national *form* of tariff the basis of which the consumer could readily understand.

The general unification of charges for the same type of supply should be encouraged but not pressed beyond the bounds of economic possibility. It is recommended that a special committee should be formed within the industry to advise the Electricity Commissioners on a suitable form of tariff which when approved by the Commissioners should be made obligatory upon all undertakers.

As regards systems and voltages of supply, it is proposed that the Ministry of Fuel and Power should be empowered to require undertakings to adopt a standard three-phase, 400/230-V, 50-cycle system within a given period of years. The cost should be met by the individual undertakings, who would ultimately benefit, assistance being given if necessary by the advance of money by the Government at a low rate of interest.

Adoption of the foregoing recommendations, it is held, would involve the expenditure of many millions of pounds and for some years would provide extensive employment in the manufacturing and contracting branches of the electrical industry and in other incidental directions. It is realised that there may be a shortage of materials after the war but delay becomes increasingly costly.

Cheaper Appliances

A standard system of supply should lower the cost of appliances and bring them within easier reach of consumers. Development would be hastened if all undertakings were compelled to offer the principal domestic appliances on reasonable hire or hire-purchase terms. An adequate maintenance service should be available.

Economies in manufacture would also arise from a greater measure of standardisation in the design and dimensions of appliances. Reference is made to the useful measure of co-operation in this respect initiated by E.D.A.

Where overlapping rights of supply result in the duplication of mains and plant within an area steps should be taken to remove any anomalies that exist.

Most of the existing rural supplies are given by overhead lines to areas in which there is a sufficient density of population to make the supplies self-supporting financially within a reasonable period. Although supplies to remote districts or to isolated farms and other buildings present no engineering difficulty they cannot be given except at heavy cost, frequently beyond the consumers' means.

While rural supplies have already been subsidised by urban consumers to a limited extent, this system cannot be extended indefinitely without seriously affecting electrical development in industry and urban homes. Rural electrification is not solely the concern of the electricity supply industry. Other industries and several Government Departments are interested in the question and the problems should be considered jointly with a view to the production of practical proposals for their solution.

Future Organisation

Various methods of reorganising the industry could be adopted. Some would cause a drastic upheaval; others would rely upon the goodwill and co-operation of all concerned. From practical experience, the group unanimously agrees that supplying electricity is a dynamic business enterprise which by highly technical engineering processes and up-to-date commercial methods already brings an important commodity into some ten million homes and factories throughout the country. The diversity of application and the extent of use will increase as technical development proceeds.

An industry which is so progressive and so capable of improving domestic comfort and industrial prosperity demands flexible control and an intimate understanding of its problems. Unlike generation for bulk supply, the retail distribution of electricity is essentially a matter for local control and action and personal contact.

Competition between neighbouring undertakings to give the greatest and cheapest service has been a valuable factor in the growth of the industry. A drastic reduction in the number of authorised undertakings would not necessarily result in lower prices or a more efficient service. While local administration and control should be retained, greater co-operation than has hitherto been possible under past legislation is desirable. The future success of the industry will depend largely upon the confidence and enthusiasm of the people who will continue to carry on the work and any reorganisation scheme should not disturb this keenness and goodwill.

Area Committees

Therefore, it is considered that a policy of organised co-operation is most likely to lead to the greatest future progress. First, it is recommended that the Electricity Commissioners shall use their existing powers to appoint an Advisory Committee to make recommendations for the division of the country into a number of electricity distribution areas. These areas should be sufficiently large to include extensive rural and urban districts with a wide diversity of loads.

In each area determined by the Commissioners there should be a permanent

committee appointed by the authorised undertakings on such a basis as to give equitable representation to the various sections of the industry in the area. The committee should comprise not fewer than ten or more than fourteen members of whom not less than half should be engineers engaged in undertakings in the area. There should be a paid chairman, appointed by the Commissioners, and the necessary staff, the expenses being met by a levy on the undertakings.

Grouping and Interconnection

The Area Committees would make a survey of their areas with particular reference to the organisation of authorised undertakings and the availability of supplies. They would make recommendations to the Commissioners regarding the exercise of local authorities' purchase rights and regarding the grouping or interconnection of undertakings and adjustment of boundaries to improve the service to consumers.

Investigations would be made of the need for supplies to rural areas and recommendations made for financial aid where it was deemed necessary. Standardisation of systems of supply would be pursued and the Committees would make recommendations to meet the electrical needs of industries within their areas.

Bulk supply tariffs and charges to consumers would be examined with a view to securing uniformity and the provision of showrooms, hire and hire-purchase, central maintenance depots, and central purchasing agencies would be encouraged.

In conjunction with E.D.A. all types of sales development work would be fostered and the services of specialist advisers would be made available to undertakings. At regular intervals matters of mutual interest or of benefit to consumers would be discussed with representatives of public authorities and industrialists.

The temporary suspension of local authorities' purchase rights pending investigations by Area Committees is recommended. Any objections by undertakings to proposals of Area Committees would be the subject of local inquiries by the Electricity Commissioners. In the matter of amalgamation or acquisition of an undertaking, except with the consent of the parties concerned, there would be a right of appeal to the Ministry of Fuel and Power. Except in cases where there was mutual agreement, no undertaking or part of an undertaking should be transferred unless the Commissioners or the Ministry were satisfied that substantial and permanent benefit to the consumers would result.

Strengthening the Commission

In view of the additional duties which would be imposed upon them, it is recommended that the Electricity Commissioners should be brought up to the full number permitted by the 1919 Act, *i.e.*, five. It is also recommended that the Commission should be removed from Treasury control and that salaries commensurate with the work and responsibility should be offered to the Commission and its staff to attract people with the most appropriate qualifications.

The position of the Central Electricity Board will have to be considered under any re-orientation of the distribution systems of the country with a view to making any necessary modifications.

It is considered that the British Electrical Development Association should continue to be an integral feature of the post-war industry and all undertakings should be obliged to contribute to its expenses.

Where contributions from municipal undertakings' funds for the relief of rates are detrimental to the interests of the consuming public the practice should be prohibited. It is suggested that consideration should be given to the extension beyond London of the sliding-scale system which relates dividends paid to the prices charged to consumers by company undertakings.

Other points in the memorandum are proposals that the Sankey Committee on holding companies should be asked to resume its investigations; that the financial year of all undertakings should coincide with that of the Central Board; that anomalies in the assessment of undertakings for rating should be removed; that electricity legislation should be codified; that there should be uniformity in the financial control of undertakings; and that competition between electricity and other fuel industries, which has stimulated progress, should not be smothered.

I.M.E.A. Memorandum

A separate memorandum upon the ownership of generating stations and distribution undertakings and a national standard bulk supply tariff has been prepared by the Incorporated Municipal Electrical Association for presentation to the Ministry of Fuel and Power. This is to be made public when it has secured the approval of members.

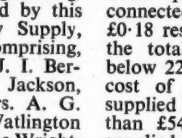
Australian Trams' Good Record

THE operation of trams and buses by the Melbourne and Metropolitan Tramways Board during 1942-43 has shown the former to need fewer repairs. Mr. H. Bell, the chairman of the Board, reports that on a mileage basis buses developed five times as many defects as trams. In actual figures, bus withdrawals for repair numbered 6,115 while there were only 3,307 cases of tramcar defects, although the average daily maximum number of trams operating was 582 as compared with 228 buses. Furthermore, Mr. Bell states that trams were by far the more profitable vehicles to operate. Last year the traffic receipts per mile of single track were £11,939 for trams and £5,788 for buses.

Post-War Supply

I.E.E. Views on Distribution and Installation

IN March, 1941, the Institution of Electrical Engineers appointed a Committee to examine matters relating to post-war planning in electrical engineering. Among the sub-committees formed by this Committee was one on Electricity Supply, Distribution and Installation, comprising, Messrs. J. R. Beard (chairman), J. I. Bernard, P. V. Hunter and Forbes Jackson, Lt.-Col. S. E. Monkhouse, Messrs. A. G. Ramsey, J. W. J. Townley, V. Watlington and W. J. H. Wood and Sir Johnstone Wright. Members of this Sub-Committee formed panels dealing with special subjects, together with Messrs. J. W. Leach, H. Nimmo, H. W. Grimmitt and E. Jacobi. Assistance was also received from panels set up by the North-Western and North-Eastern Centres. A report prepared by the Sub-Committee has been adopted by the main Committee and it was published last week-end.



Mr. J. R. Beard is chairman of the I.E.E. Post-war Planning Committee

In dealing with electricity supply, the report excludes generation and main transmission, which are already taken care of by the Central Electricity Board. Standardisation of voltages and systems are first considered. One of the urgent problems here is the continued expansion of non-standard undertaking in which there is often reluctance to incur expenditure which is not immediately remunerative. This raises financial and administrative questions which must be left for discussion between the supply industry and the Government. The report endeavours only to give data from which a scheme for achieving national standardisation of voltages and systems could be evolved. The matter is one which should receive immediate attention after the war in view of the vast prospective building programme.

Reduction in Non-Standard Supplies

It is shown that as the result of previous activities the number of undertakings with standard AC systems rose from 168 to 437 between 1926–27 and 1937–38, but there were still 159 DC undertakings (114 standard voltage) and 229 non-standard AC systems (112 above and 117 below standard voltage). In 1937–38 about half of the consumers were supplied at standard voltage.

Questionnaires circulated by the Electricity Commissioners have enabled it to be estimated that the cost of raising below-standard AC systems to the standard voltage would be £6·33 per consumer or £2·18 per kWh connected for below 220 V and £0·57 and £0·18 respectively for 220 V. On this basis the total cost would be £11,450,000 for below 220 V and £180,000 for 220 V. The cost of changing-over 947,000 consumers supplied at 240 V is estimated at not more than £540,000 and for 765,000 consumers supplied at 250 V at £3,630,000. Thus the total cost would be £15,800,000 and the cost of standardising DC voltages is put at £1,655,000.

There were still 1,117,000 DC consumers in 1937–8 but there has been a progressive reduction and it is thought that they do not now number more than 10 per cent. of the total. No estimate can be made of the cost of conversion but it is considered that any financial assistance afforded for voltage standardisation would have a beneficial effect in speeding up the change-over of systems to AC. The advantages to undertakings of changing over non-standard AC systems is also stressed.

It is recommended that the standardisation of low-voltage systems should be treated as a National Industrial Plan so as to evoke the enthusiasm and goodwill of the consumer, the undertaker and the manufacturing industry in co-operating to complete the plan in the shortest possible time to limit its total cost and quickly secure the advantages. The work can be completed within five years. After the war, the addition of load to non-standard systems should be limited.

Rural Development

The next section of the report relates to the availability of supplies. Reference is made to progress in this direction and the factors affecting development, and it is said that in 1939 74 per cent. of the 10·7 million dwelling houses in urban areas in Great Britain were receiving a supply.

The number of premises in rural areas is about 2·25 million and there are 1·25 million consumers of whom 1·1 million are domestic and at least 35,000 are farms. Progress has been assisted by making the approval of special Orders subject to the undertakers

agreeing to establish transformer supply points at a number of specified voltages in the area within a determined period instead of the usual provisions for compulsory works in specified streets.

The cost of connecting up isolated premises being often economically unjustifiable, has tended to retard development. It is generally agreed that some financial aid may be needed if rural electrification is to be expedited. Possibly subsidies to meet the cost of connecting "remote" consumers might be granted in relation to a considered scheme for a whole district.

Wayleave matters are considered and it is thought that the procedure for the hearing of objections should be speeded up and that the responsible Minister should be empowered to fix rentals and compensation. There should be a general simplification of procedure and an easing of restrictions.

Regarding charges for urban service lines, the Sub-Committee recommends that all undertakings should consider the question of agreeing upon the standard length of service which they would be willing to lay free on private property.

It is necessary to give special consideration to services in rural areas. While it may be possible to cheapen high-voltage spur lines by relaxing the Overhead Lines Regulations, in few cases can an undertaking afford to provide a spur line and transforming equipment unless the consumer contributes to the cost or a subsidy is provided.

Tenant farmers in England are deterred from providing installations by their being denied any compensation for the improvement when vacating their farms. It is thought that legislation such as has been provided for Scotland should remedy this. Financial assistance may be expedient if the use of electricity in farms is to be encouraged.

Complete statistics of the growth of rural electricity supply are not available but it is shown that in 1929 there were 3,700 miles of l.v. mains and in 1939 20,000 miles. A table shows the steady growth in the number of annual overhead line consents from 901 in 1930 to 5,243 in 1939.

Forms of Tariff

It is considered that the time has arrived to prepare a definite scheme for securing a greater measure of uniformity of tariffs for general adoption at an appropriate time. Accordingly the Sub-Committee makes a number of recommendations regarding the *forms* of tariffs, not prices, for non-industrial consumers. Industrial tariffs are of a special character.

The origin and development of two-part tariffs is reviewed and it is shown that the chief problem is to find an equitable and satisfactory basis for assessing the fixed, or primary, charge so that each consumer pays his fair share of the overhead charges. A sufficiently accurate result is obtained if groups of consumers of the same type are assessed on the same basis and four groups are set out :—Domestic, farm, industrial (small power) and commercial, the last including all consumers such as shops, schools, institutions, etc., not covered by the first three.

Domestic consumers may be assessed on floor area, rateable value or number of rooms; each has advantages and disadvantages but there is a general trend towards the adoption of the floor area method. For farms the floor area of closed buildings seems to be as satisfactory a basis as any other. Alternatively the installed horse-power of motors and installed wattage of heating and lighting might be used as a basis.

In the case of small power users it is thought that a satisfactory method might be to take account of the horse-power of motors installed, the lighting wattage and the connected heating load. If this is accepted it might also apply to commercial consumers, possibly coupled in both cases with an alternative maximum-demand charge.

Encouragement of Two-Part Tariffs

The undoubted advantages of the two-part tariff make it desirable to secure its general adoption. The Electricity Commissioners might be given power to approve of an undertaking offering a two-part tariff only, provided the price per kWh did not exceed a specified figure, not above the permitted maximum. In the meantime the Commissioners should urge undertakings to offer consumers transference to the two-part tariff subject to the specified conditions.

An attractive alternative form of the domestic two-part tariff is a two-rate variable-block tariff. The advantages are that it can be offered as the statutory tariff; it meets the case of an undertaking with a low lighting flat-rate, which makes it difficult to persuade consumers to adopt a two-part tariff, as the number of units in the first block can be made correspondingly greater; and it automatically protects small lighting consumers. A three-rate variable-block tariff has certain advantages.

A two-rate variable-block tariff was recommended by the 1930 Committee on Tariffs for small industrial power supplies. This might well be transformed into a "one-meter tariff" for small power users by adding to the number of units at the higher rate per horse-power installed another number of units per kW of lighting installed. A further number of units at the higher rate might be charged for heating load and the tariff would then become applicable to commercial consumers as well.

It is not considered that these tariffs would normally need a coal clause as the terms can

usually be quickly varied to suit any abnormal variation in the price of coal. It may be necessary to apply some system of peak-load restriction to that portion of the supply which can be temporarily interrupted. Abnormal capital costs incurred in respect of any consumer should preferably be recovered, leaving the consumer on the same or nearly the same terms as other consumers although sometimes it may be desirable to make special service charges or stipulate a guaranteed revenue.

Installation

The Institution's Regulations for the Electrical Equipment of Buildings have formed the standard code of practice for the last sixty years. They have gradually been added to, and the original framework has been complicated by cross-references. It is felt that the time is opportune to revise the form of the Regulations by separating the fundamental principles from the details of application. If this is accepted, their division into Basic Safety Regulations and separate supporting Codes of Good Practice is recommended. The safety regulations should be in the simplest possible form and accompanied by a Code of Practical Interpretation. The Codes of Practice should deal separately with various classes of buildings. This section would be taken over by the Codes of Practice Committee for Civil Engineering, Public Works, Building and Construction Work, set up by the Ministry of Works, with which the Institution is co-operating.

The Sub-Committee has studied the desirability of legislative control of the electrical equipment of buildings by statutory wiring regulations or compulsory registration of contractors or operatives. An investigation of the technical aspects has led to the conclusions that, in themselves, they do not provide evidence sufficiently serious to justify compulsory registration; that there is insufficient ground for compulsory regulations at present, although if it were generally agreed in future that such a course was necessary the proposed Basic Safety Regulations would probably meet the requirements; and that the statistical evidence indicates that a reduction of the small electrical accident and fire rate should be sought in four main directions :—The inspection by supply undertakings of installations for compliance with Electricity Supply Regulation No. 27 (1937); the encouragement by supply undertakings of the observance of the Wiring Regulations and of the use of the existing voluntary system of registration of contractors; emphasis on the importance of the use of non-kinkable flexible cords for portable appliances; and the manufacture of all accessories and apparatus to British Standard Specifications which should be so extended as to be as specific as possible.

Meter Testing Facilities

NEW instruments and some of their applications are discussed in two short papers submitted by Mr. Arvon Glynne (College of Technology, Manchester) to the Measurements Section of the I.E.E.

The author first reviews the characteristics of the high voltage supply needed in meter testing stations established under the Electricity Supply (Meters) Act, 1936, and then explains the theory and construction of a new electronic stabiliser and regulator for furnishing DC at a voltage so constant as greatly to facilitate voltmeter and wattmeter standardisation measurements in accordance with the requirements of the above mentioned Act.

The apparatus is intended to be an alternative to the high-voltage battery in instrument standardising stations, avoiding many of the troubles peculiar to secondary cells. In its present form it is the equivalent of a battery with an internal resistance of 2·5 ohms whose EMF can be smoothly adjusted to within one part in 20,000 over a range of 80 to 600 V, the voltage remaining steady to within one part in 100,000 for a few minutes and to within one part in 10,000 indefinitely.

More than 100 mA is obtainable, or a much greater output at a somewhat reduced degree of stability. The standard voltage against which the output is compared is provided by a dry cell, which is not called upon to furnish any current, so it will have a long life. It is desirable that the input voltage to the valve circuit be adjustable, but not critically, the author utilising a separately excited DC generator that is driven by a synchronous induction motor; self-excitation would not be suitable.

The device can be made portable. It should be additionally useful for energising experimental furnaces, or photocells that require a light source of very constant candle power ; it is also more convenient and constant than batteries for calibrating moving-coil instruments, as well as for standardising AC potentiometers and checking the equality of their resistance sections.

The second portion of the author's paper describes a simple form of co-ordinate AC potentiometer, which requires little operating power and is very light and portable, for precision testing the ratio and phase errors of instrument voltage transformers.

It may also be employed to measure the errors of current transformers, the author describing several methods which avoid the difficulties inherent in the more usual "spill" current procedure.

PERSONAL and SOCIAL

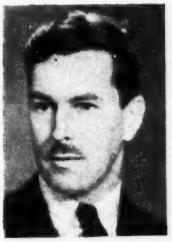
News of Men and Women of the Industry

AT this week's meeting of the London and Home Counties Joint Electricity Authority, the General Purposes Committee reported on arrangements made with regard to the superannuation allowance of **Mr. F. W. Purse**, the Authority's chief engineer, who was due to retire on February 5th. It was mentioned that in November last the Authority decided to re-engage Mr. Purse in its temporary service as from February 5th.

Mr. A. R. Chapman, B.Sc., A.M.I.Mech.E., who, as announced last week, has been appointed deputy general sales manager to Babcock & Wilcox, Ltd., is an Associate of the City and Guilds Institute, South Kensington, where he received his technical education from 1916 to 1920, with a year's absence on military service. He joined Babcock & Wilcox, Ltd., in 1920, serving three years as an apprentice in their Renfrew Works, and later going abroad on construction work. Since 1933 Mr. Chapman has been engaged on sales work, except for the last three years, during which he has been undertaking special duties at the Renfrew Works. Mr Chapman has returned to London to take up his new appointment.

Mr. A. R. Chapman

Mr. H. McNeil, A.M.I.Mech.E., A.M.I.E.E., who becomes deputy chief engineer of the same company, was born in New Zealand and took an engineering degree at the New Zealand University. Following this, he spent two years with the New Zealand Public Works Department in connection with the various hydro-electric schemes in the North Island. He then joined the State Electricity Commission of Victoria, coming to this country in 1931 to join Babcock & Wilcox, Ltd. Since then he has had a wide experience in the various engineering departments of the company, including a period when he was in control of the design and building of a peat briquetting factory in Ireland. In 1940 Mr. McNeil was lent to the works for special duties connected with the war effort but has now returned to London.



Mr. H. McNeil

Mr. W. R. Murray, burgh electrical engineer, Stirling, is retiring. Mr. Murray, who had previously intimated his desire to retire on January 15th, has informed the Electricity Undertaking Committee that he is prepared to continue in his post until May 15th next.

Mr. B. Clayton has ceased to be a director of Powell & Lee, Ltd. For some time he has taken no active part in this business.

Dr. Eric Wilkinson, lecturer in electrical engineering at Loughborough College, has been appointed head of the Electrical Engineering Department of Robert Gordon's Technical College, Aberdeen. Dr. Wilkinson, who has held his present post since 1935, is a graduate of Liverpool University. He holds the degrees of B.Eng. and Ph.D., and is an associate member of the Institution of Electrical Engineers.

On January 26th **Alderman Sir Percival Bower** was presented by the Lord Mayor of Birmingham with a resolution passed at a meeting of the Electric Supply Committee when he retired last November. The resolution was in the form of a handsome illuminated copy in album form. It expressed appreciation of the excellent services rendered by Sir Percival to the city and to the electricity supply undertaking over a period of twenty-four years, and recorded the fact that he joined the Committee in 1919 and was appointed chairman of the Works Sub-committee in 1926, succeeding to the position of chairman of the Electric Supply Committee in 1931.

Sir Percival Bower, in replying, said that the Birmingham undertaking to-day was in the top rank from every point of view. As to the future of the industry he was perfectly certain that if reorganisation had got to come it could not be carried out satisfactorily by divorcing generation and distribution. If a case could be made out for the nationalisation of big generating services, then an overwhelming case could be made out for the complete nationalisation of the distribution system.

Sir Richard Gregory has received from the Council of the British Association, of which he has been president since 1940, a message of good wishes on his eightieth birthday, conveying the Association's thanks for his services during his term of office "unprecedented alike in duration and circumstance."

Dr. Oscar Faber will be inducted as president of the Institution of Heating and Ventilating Engineers at the annual meeting on Wednesday next at the Connaught Rooms, London, W.C.2.

Sir Lawrence Bragg, F.R.S., **Dr. Irving Langmuir**, the eminent American physicist, and **Professor P. Kapitza**, F.R.S., the Russian scientist whose work at the Cavendish Laboratory, Cambridge, gave him prominence in this country, have been elected honorary members of the Institute of Metals. The fourth principal Allied nation, China, is similarly honoured in the person of **Mme Chiang Kai-Shek**.

Mr. Samuel Lees, senior electrical engineer surveyor with the Eagle Star Insurance Co., Ltd. (Manchester Branch), is retiring after nearly twenty-five years' service in the company's Engineering Department. For several years Mr. Lees was an electrical inspector for the Vulcan Boiler & General Insurance Co., Ltd., Manchester. Previously, for several years he held the position of outside inspecting engineer with the James Keith & Blackman Co., Ltd. From

1896 onwards he was engaged in electricity supply work, holding important posts at Oldham, Bradford, Wigan, Belfast and Stretford (Manchester). Mr. Lees has been a regular contributor to the engineering Press, including the *Electrical Review*.

In the late 'nineties when Lord Kelvin and several other eminent scientists were carrying out a series of heat surveys on municipal destructor plants in conjunction with steam-raising for electricity works, Mr. Lees was engaged at one of these plants recording meter readings, logging tests and the like, for the great men of those days.

Mr. D. M. Evans Bevan has been appointed a director of Edmundsons Electricity Corporation, Ltd., and the South Wales Electric Power Co.

Sir Thomas Royden has been appointed chairman of the Wessex Electricity Co.

Mr. H. A. C. Ridsdale, of Gosforth, a power engineer with the North-Eastern Electric Supply Co., Ltd., has been adopted as Common Wealth Parliamentary candidate for the North Division, Newcastle-on-Tyne.

Lord Reith and **Sir John Wardlaw-Milne,** M.P., have been elected to the court of Cable & Wireless (Holding), Ltd., Cable & Wireless, Ltd., and to the boards of the associated cable companies.

Miss Mildred A. Bennett, of the Walthamstow Electricity Department, has been awarded the Elizabeth Sloan Chesser Cup, held by the demonstrator who gains the highest marks in the Electrical Association for Women diploma tests during the year. She obtained her diploma with first class and distinction in cookery, first class in laundry, and first class and distinction in salesmanship.

Mr. H. A. Deacon, sales manager of Cryselco, Ltd., who has recently completed twenty-five years' service with the company, has been appointed general manager. **Mr. S. Elliott-Smith,** assistant sales manager, has been appointed sales manager.

Obituary

Mr. A. V. Anderson.—The death occurred suddenly on January 19th, after an operation, of Mr. Arthur Victor Anderson, station superintendent at the Huddersfield Corporation electricity works. He was sixty years of age and had been in the service of the Corporation at the electricity works for forty-three years. Mr. Anderson took a keen interest in the training of young engineers.

Mr. Herbert L. Critchley, O.B.E., who died at Lytham St. Annes recently, at the age of sixty-six, had been general manager for Babcock & Wilcox, Ltd., at Renfrew, before retiring about ten years ago. He was deputy mayor of Lytham.

Mrs. M. M. Chamen, widow of Mr. W. A. Chamen, who was engineer and general manager of the South Wales Electrical Power Distribution Co., died at Eastbourne on January 27th, at the age of seventy-eight. Mr. Chamen died in 1928.

Radio Problems

"Transmission Line" Considerations

ANALYSIS of the behaviour of so-called "transmission lines" employed for interconnecting component parts of very-high-frequency equipment as well as inductive capacitive elements within such apparatus, which operate at a very short wavelength or fraction thereof, is greatly facilitated by the use of the circle diagram of impedance. The theory of the method is explained and illustrated with a number of examples by Prof. Willis Jackson (University of Manchester) and Dr. L. G. H. Huxley (Ministry of Aircraft Production) in a paper submitted to the I.E.E. Wireless Section.

The authors discuss mathematically the fundamental principles underlying the basic transmission-line equations on which their method of solving such problems is founded, and the meaning to be attached to the word "impedance" at very high frequencies in respect of terminating attachments to lengths of transmission line. The paper concludes with an examination of the physical possibility of producing a non-reflecting termination, which has an effective "impedance" equal to the characteristic impedance of the line. On one aspect of the latter point there appears to have been much misunderstanding, which the authors hope their paper will remove.

It follows from their solution of basic equations that if a line is terminated in an impedance equal to its characteristic impedance, then a reflected wave will not be generated at the termination. At very high frequencies impedance is purely resistive, so that apparently all that is required is to produce a pure resistance of equal value in such a form that its attachment to the end of the line does not disturb the transverse nature of the field distribution. Ideally, this can be done for the coaxial line by closing the end with a disc resistor consisting of a film of graphite supported on thin bakelised paper and having the appropriate direct current ohmic value.

Now that such discs are available commercially the authors have been able to check the arrangement they describe experimentally, in clarification of two possible explanations of the result achieved.

Colne Electricity Charges

In our January 28th issue we reported that the Electricity Commissioners had refused to sanction an increase in charges. This should have referred to the Colne Valley Council's undertaking and not Colne as stated.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Bathroom Deaths

A LEADERETTE in your January 21st issue deals with the electrical accidents which occur in bathrooms. This is also clearly stressed in H.M. Chief Electrical Inspector's Report on Electrical Accidents, 1942.

Water and gas supply require expert advice and their installation is usually subject to official inspection; yet electrical installations can be tampered with by the most blissfully ignorant. This seems to be a reflection on our methods of ensuring safety in domestic installations.

I would most strongly urge the starting of a campaign by the Installations Section of the I.E.E. in order to bring about legislation which would prevent these most unfortunate accidents. Electrical energy should be wired to certain plug points in certain rooms, and portable appliances allowed only in these rooms. If the heating (or lighting) of special places is found to be necessary, application for permanent installation should be necessary and the work done by a registered electrical contractor.

As a further assurance that unsafe work shall not be done, I further suggest that the "meter man" be a qualified electrician so that he can be appointed as an inspector; or *vice versa*, area electrical inspectors might be appointed who would, during their rounds, take meter readings. Conversely, they could serve as a consultative body of men who could go out to the home and give advice when requests were received for electrical installations or extensions.

Rugby. F. H. E. MYERS,
A.M.I.E.E., A.M.W.M.A.
Chief Test Engineer, B.T.H. Co.

Kitchen Planning

MR. J. SCOTT in your January 21st issue mentioned some details of kitchen planning, with particular reference to refrigerators. If Mr. Scott will examine the "Bradford" unit a little further, he will observe that the position of the refrigerator in relation to other components is generally in line with his suggestions. As a matter of fact, the refrigerator and other components can be so arranged in the Bradford kitchen as to cater for many possible variations of lay-out.

Unless a house has a very good keeping cellar, a refrigerator is almost necessary if food is not to be wasted. A refrigerator is not an ice-cream maker, although it will make it if desired. Surely the true purpose is the preservation of food which in peacetime would include meat, fats, milk, salads, etc.

The facilities required to give access to the refrigerator, as suggested by Mr. Scott, are all included. The refrigerator is on the window side and near the door, so that Mr. Scott's requirements could easily be met.

The space required to permit of an ideal kitchen lay-out is of prime importance and demands the closest co-operation of architects and engineers if a satisfactory solution is to be obtained. Housing and planning committees usually have the last word in such matters, and quite often do not appreciate the importance attached to their decisions. I thank Mr. Scott for his interest in the "Bradford" unit.

Bradford. T. H. CARR,
Electrical Engineer and Manager.

Dynamic Braking

I AM obliged by Mr. Millar's reply in your issue of January 21st. I am in agreement with the deduced expression for equivalent resistance, my previous disagreement being due to my having erroneously got the indices of r_2 and SX_M interchanged, which led me to conclude that equivalent impedance rather than equivalent resistance had been used. The numerator of the imaginary component in the expression quoted in Mr. Millar's reply requires correction insofar as r_2^2 should be substituted for $(SX_M)^2$.

It is doubted whether rotor reactance can be omitted on the score of simplification and I would prefer to obtain the speed-torque curve with DC excitation from that derived with AC excitation, thus: The usual simplified torque equation for an induction motor is $T = \frac{\phi^2 \cdot fs \cdot R}{R^2 + f_s^2 X^2}$ where T = torque expressed as ratio of full load torque, ϕ = flux entering rotor as ratio of normal value, s = fractional slip, R = rotor resistance per phase (internal and external) and X = standstill rotor reactance per phase. Both R and X are expressed as a ratio of $\frac{E}{\sqrt{3}\,I}$, where E = standstill rotor volts between rings and I = full load rotor current. Expressing the various quantities as ratios is, of course, simply a convenience.

Providing $R \leq X$, then with constant flux the maximum torque which a slip-ring motor develops in accelerating to full speed is determined only by its rotor reactance; the speed at which the maximum torque occurs can be changed by altering the value of resistance in the rotor circuit. If the machine has AC excitation at 50 cycles per second, the fre-

quency of the rotor currents will be zero and 50 cycles at synchronous speed and standstill respectively. On the other hand, with DC excitation, the corresponding frequencies will be 50 and zero respectively.

With the DC excitation chosen to produce the same flux as with AC, then surely the same speed-torque curve applies except that the speed base will require reversing for the reason outlined in the preceding paragraph and, of course, with the same assumptions as underlie Mr. Millar's argument. Thus we have a speed-torque curve with a speed base of from zero to synchronous speed for motoring with AC excitation and from synchronous speed to zero for braking with DC excitation. The torque values will require adjustment as the square of the flux for other values of DC excitation. The rotor reactance alone has thus fixed the maxium braking torque for each value of excitation when $R \leq X$. Taking the rotor reactance into consideration does not seem to have introduced an unnecessary complication, but a very necessary quantity.

In regard to the last paragraph of Mr. Millar's reply, we appear to be at cross purposes. As mentioned in my previous letter: "The text states that by substituting $M = \frac{X_M}{r_2}$ in the torque equation, we get Tmax. . . ." One would naturally expect to see the symbol M appear in the equation for Tmax. The condition for maximum torque using the author's torque equation is when $r_2 = SX_M$, and he has, in effect, used this substitution.

Thus the speed at which Tmax. occurs is given by $S = \frac{r_2}{X_M}$ and is *constant* for a given braking condition. It is perhaps a matter of individual taste whether one calculates the speed at which the torque is a maximum directly from the quotient $\frac{r_2}{X_M}$ or first calculates $\frac{X_M}{r_2}$ and then its reciprocal.

St. Albans. A. D. J. RACTLIFFE, M.Sc. (Eng.) A.M.I.E.E.

Factory Maintenance

WITH reference to the article by J. Southern in your issue of December 17th, I found his remarks on factory motor bearing replacements of great interest.

I think it would be of great assistance to maintenance engineers if all manufacturers of motors and machine tools would supply details of the ball or roller bearings fitted, and give this information on the packing lists.

If the V-belt sizes also were given it would be equally useful. These belts are often enclosed in such a way that the size cannot be quickly ascertained. Furthermore, it is not uncommon to find a special maker's marking without a clear indication of the belt length.

Ball bearings and V-belts give long service, but spares are wanted quickly when they fail, and it is important to have the correct replacements at hand.

Maidstone. F. A. KING.

Testing AC Motors

WITH reference to Mr. K. Broom's article in your issue of January 21st, I would like to mention an alternative method in common use for calculating the performance of a motor. For the final calculations it is usual, however, to take the hot resistance of the motor, which is usually from 10 to 30 per cent. high. Using the same results as the author: (i) Full-load stator copper loss = A^2 (full load) $\times$ r = $6^2 \times 6$ = 216 W. (ii) Constant (iron, friction and windage) losses = no-load watts − no-load copper loss = [A^2 (no load) r] = 250 − $3^2 \times 6$ = 196 W. (iii) Rotor copper loss at full load = [Full-load watts − (stator loss (i) + constant loss (ii)] $\times \frac{\text{sync. speed–actual speed}}{\text{sync. speed}}$ = [3600 − (216 + 196)] $\times \frac{50}{1500}$ = 3188 $\times \frac{50}{1500}$ = 106 W. Total losses (when fully loaded) = 518 W. Input, 3600 W; output (input − total losses), 3082 W; horsepower, 413; efficiency, 85·6 per cent.; power factor $\frac{\text{Full-load W}}{\sqrt{3} \times \text{full-load A} \times \text{V}} = \frac{3600}{\sqrt{3} \times 6 \times 400}$ = 0·866. Taking the hot resistance will increase the losses and give results similar to those obtained by Mr. Broom.

Incidentally in Mr. Broom's article, under Item 2 in the right-hand column of p. 86, there should be a positive and not a negative sign between 196 and 6^2 and in Item 7 the power factor should be given as 0·866.

As a further measure of ensuring the success of a repair it is sometimes very useful to be able to carry out the flash test prescribed by the B.S. Specification. This consists in applying 1,000 V to the terminals of the motor for about one minute.

Friern Barnet, N. 11. E. H. WERNINCK.

Cambridge Wireless Group

THE Council of the Institution of Electrical Engineers has sanctioned the formation of a Wireless Group for Cambridge and District. The provisional Committee has as its chairman Mr. C. R. Stoner of St. Mary's College, London, for the present carrying on at Cambridge. Mr. B. J. Edwards is vice-chairman and Mr. D. I. Lawson honorary secretary. Other members are Messrs. R. H. Angus, R. S. Francis, J. G. Hammond, I. F. MacDiarmid, Dr. J. T. Randall, E. V. Root and R. W. Wilson.

The inaugural meeting is to be held in the Engineering Laboratories of the University on Thursday, February 17th, at 8 p.m., when Mr. T. E. Goldup (chairman of the I.E.E. Wireless Section) will repeat his inaugural address on "The General Aspects of Radio Engineering Progress."

Electrical Research

New Laboratories Being Planned

THE annual report of the British Electrical and Allied Industries Research Association for the year ended September, 1943, shows how remarkably wide is the range of investigational work being carried on. There has been a further increase in the amount of direct assistance to the war effort given by the E.R.A. and there is as yet no indication of any intention to reduce the demands made upon the Association in this respect.

The annual accounts show some increase in income as well as expenditure. While the financial state is sound, large inroads into the reserve funds must continue to be made for financing developments. Viscount Falmouth has consented to continue in office as president for a second year.

As has already been foreshadowed the laboratories and principal offices at Perivale, Middlesex, are no longer adequate so a fresh site has been selected near the railway station at Leatherhead, Surrey, adjacent to the site secured by the British Coal Utilisation Research Association, which offered parts to other research organisations needing better facilities with a view to securing joint action in matters of common interest and the sharing of common facilities and amenities. It is likely that this action will lead to an important group of industrial research laboratories being developed in this area. A joint consultative committee is already effectively helping the negotiations of those already committed and others seeking accommodation.

While plans for new buildings will be prepared without delay, it is not likely that constructional operations can commence at once so that further temporary provision will have to be made for relieving the serious overcrowding at Perivale.

Magnetic Materials

The Committee dealing with magnetic (now termed electrical) sheet steel for transformers has been reconstituted with a view to improving the properties of this material. A start has been made under the direction of Prof. Sir Lawrence Bragg at Cambridge University and the co-operation of steel manufacturers secured. Hitherto development has been held back because the total tonnage utilised has been relatively small. The E.R.A. now seeks to help British manufacturers to occupy the leading position in this field.

Some new problems have arisen from the permanent magnet research at the Cavendish Laboratory, but there have been no completely new experiments The compilation of an index of powder (X-ray) photographs as a means of identifying unknown substances is proceeding, and 1,000 further compounds have been identified. The advantages of utilising an electron microscope for examining metals is being explored.

Surge Phenomena

Study of surge phenomena constitutes an important section of E.R.A.'s work and reports on different protective devices are in course of preparation. A fresh theory to explain the development of a lightning stroke has been evolved, which accounts for all the observed facts. The possibility of its being also applicable to the general theory of the electric spark is being further studied.

The experimental portion of the investigation of the causes of secondary faults on a system earthed through a Petersen coil has been concluded. In addition to klydonograph and oscilloscope records, a special oscillograph has been used which consists of three cathode-ray tubes making records on a single revolving drum.

Rural Work

The low-loaded hammer mill for grain grinding on farms, which is automatically controlled and electrically operated, which was produced commercially by authority of the Ministry of Agriculture through the Agricultural Machinery Development Board, has been installed in substantial numbers on farms. A report (Trans./T170) is being circulated on preliminary work done at Reading University on the ultra-violet irradiation of chickens. A preliminary sample survey of one county has been arranged for ascertaining the general type and load classification of existing and potential farm electrical loads with a view to determining the scope for low-pressure steam in dairy sterilising.

The simplified E.R.A. method of heating salad beds electrically has met with widespread interest and appreciable response. Two seasons' work on the electrical pre-heating of tomato-house soil carried out in conjunction with Nottingham University College and the West of Scotland Agricultural College has shown the method to be economically sound. The method of heating solutions for gravel culture being carried out at Reading by Dr. R. H. Stoughton is being modified. The suspended work on electrical soil sterilisation is being resumed at Cheshunt.

Control Devices

An extensive report on comprehensive research into jewels and pivots for meters and instruments, covering the work that has been done over a period of years, is in an advanced

stage of preparation. Efforts continue towards the establishment of the fundamental principles of the performance of " hard gas " switches wherein the blast is generated from solid substances under the action of the arc. Attention has also been given to the qualities of electrodes made of various metals, the life of one particular material when used for contact tips being about ten times that of copper.

A new instrument has been developed for " triggering " a recording cathode-ray oscillograph into operation, which is cheaper and more robust than the previous system of employing electron-relay tubes, which are now very difficult to obtain.

Another new device has been designed to control the timing of a series of mechanical switching operations to a high degree of accuracy. In a sequence of four operations time differences of a tenth down to a thousandth of a second can be secured within an error of about plus or minus 1 per cent. on the overall time. There is also a means of selecting the time of actuating the trips.

More sensitive methods of measuring low wind velocities have been devised for determining the current-carrying capacity of overhead lines. Several reports have been drafted on the effectiveness of certain ways (one of which is new) of improving the continuity of conduit joints. In connection with earthing to water mains, information on the resistance to corrosion of different clip-pipe combinations has been obtained for completing a B.S. specification, while an AC/DC amplifier of novel properties has been made.

In view of the apparent increasing tendency of cable purchasers to stipulate (before they specify the cable size) that the thermal resistivity of the soil along the proposed route shall be determined by the E.R.A. method, information that has been given to cable manufacturers to enable them to construct the necessary apparatus and carry out the tests in future should be widely applicable to the more important cable-laying contracts.

Dielectrics

Not so very long ago all the data about the specific properties of the insulating substances could be tabulated on a single sheet of paper. Last year the E.R.A. alone issued reports representing an expenditure of upward of £10,000 on this subject. The value of statistical methods of assessment of quality is receiving increasing attention, for instance in connection with accelerated life tests on radio capacitors.

Some materials appear to be more susceptible than others to corona in voids and air spaces within and around the insulation of high voltage equipment. Two independent forms of electrical deterioration have been shown to result therefrom; the theory is discussed in report L/T137.

Results of some interest have been obtained on the rheological properties of dielectrics, involving the relationship between deformation and variable stress, temperature and time. An electrical method of applying great stress of short duration has been used which employs the E.R.A. circuit-breaker testing plant. The advantage of the method is that the test conditions are essentially similar to those which apply to transformer insulation in service when exposed to hazards from fault currents. Additional apparatus has been made for measuring small compressive strains and preliminary results suggest phenomena of significance.

Compounds

Draft proposals for a B.S. Specification have shown that three tests of the brittleness of bitumen are required according to the conditions under which the compound is to be used. At the request of the Ministry of Fuel and Power the possibility of using wool pitch as a substitute for bitumen is being ascertained in order to save shipping space.

In view of the shortage of raw rubber the use of ebonite dust in compounding ebonite has acquired increased importance. While in soft rubber the nature of the end product is altered by the increased sulphur combination rendered possible by the inclusion of organic accelerators, it has been found that the end product of the ebonite reaction is not substantially affected thereby, only the rate of reaction being changed. The favourable electrical properties of silica as an effective filler for low-loss ebonite is commented on.

Detailed descriptions have been prepared of methods of preparing miniature specimens cut from finished mouldings for the purpose of testing the properties of the full-size article. Anomalies have been observed in the moisture absorption of mouldings before and after removal of their " skin."

Additional reports are being prepared on the properties of a wide range of hard composite dielectrics for use at high frequencies, but it has not been possible to pursue researches into the properties of various kinds of paper because the facilities have been devoted to allied problems forming confidential investigations for the various Ministries. But the experience so gained will probably modify treatment when ordinary study of the subject is resumed.

The annual report makes repeated reference to work that has had to be suspended, or is being hampered, by reduction of testing staff and allocation of facilities to secret investigations of greater urgency in the national war effort. Unfortunately, certain requirements could be satisfied only by transfer of individual members of the trained E.R.A. staff to Service Departments, but the Association has the satisfaction of knowing that those members are rendering important service.

Radio-Frequency Heating

Industrial Applications Reviewed

AT an informal meeting of the Institution of Electrical Engineers on January 24th there was a discussion on "Industrial Applications of Radio-Frequency Methods of Heating." The opening speaker was Mr. N. R. Bligh, who said that the discussion would cover the uses of AC at frequencies above a few hundred kilocycles. Many of the applications of radio-frequency heating had progressed further in America than over here.

The two main fields of application were, first, where heating was due to eddy currents induced in a conducting charge—referred to as e.c.h. or eddy current heating; and, secondly, where heating was due to displacement currents in an imperfect dielectric—referred to as c.c.h. or capacity current heating. Some standardisation of terminology for popular usage, at least, was called for. A third heating field was where the use of radio-frequency currents was only involved because such currents could be led into the charge through small capacities. The actual heating process, however, was of the class usually called resistance heating.

Rating of Generators

The valve generator appeared to be capable of producing all the power yet required for any application, even up to the highest frequencies of some hundreds of megacycles.

Mr. Bligh suggested that the only power rating which should be stated for a radio-frequency generator was its power output into the optimum resistance load, though for convenience the volt-ampere rating might be given additionally. The self-oscillator was regarded as the simplest form of generator and a number of typical circuits were shown and described. With regard to the type of valve employed, up to a few hundred watts glass envelope valves could be used but, beyond this, external anode valves were preferable.

As to the load circuits proper, for c.c.h., the charge was placed between condenser plates. In many cases, such as heating in a press, one side of the load was preferably at earth potential. As the cold platens of a press would often destroy the merit of c.c.h., *viz.*, uniform temperature rise throughout the mass of the charge, the electrodes should have low thermal capacity, be lagged and/or be heated. This enabled a high degree of uniformity of heating to be obtained.

In the case of e.c.h., it was desirable to have the heating coil as tightly coupled to the charge as mechanical and electrical conditions would allow. The shape of the heating coil was best arrived at by considering the surface planes to be heated and the paths in which the eddy currents could flow. The coil turns should then be as close to those planes as possible, and the turns parallel to the eddy current paths.

On the point whether to distribute power at 50 cycles and have localised convertors to develop radio-frequency energy, or to generate the radio-frequency energy centrally and distribute at high frequency, Mr. Bligh thought the latter to be some way off yet. Another alternative was a central high-voltage transformer, with or without a rectifier, to distribute high voltage—D.C. or A.C. respectively—to local oscillators. Although this scheme would keep down the size of the radio-frequency generator, it was not regarded as very promising.

Indication of Costs

The difficulty of mentioning costs in wartime was emphasised but a figure of £100 per kW of radio-frequency output was mentioned for the larger sets, and possibly twice as much for smaller sets. This cost also depended on how conservative a rating the manufacturer adopted and on the "factors of safety."

A number of uses for radio-frequency heating in industry were mentioned, special reference being made to the plastics branch. Other applications of c.c.h. were the completion of the dehydration of food and the bonding of thin layers of thermo-plastic materials such as vinyl-resins and the cellulose esters. In the e.c.h. field its application to the production of thermionic valves was of long standing, while the heat treating of surfaces and heating of very small items were becoming increasingly common. In general, operating costs appeared to be reasonable. Radio interference risks were also touched upon.

It was generally agreed among the many speakers who took part that a serious effort must soon be made to standardise terminology, and one speaker emphasised that the terms decided upon should have some meaning to the ordinary user.

Interference with radio communications received considerable attention. The outstanding suggestions made in this matter were either to adopt perfect screening or to have allocations of frequency bands for industrial heating, although it was not thought the latter alternative would be popular in certain quarters.

Another general aspect which received attention was the undesirability of urging the use of radio-frequency heating methods for all and every purpose. For many industrial purposes existing means should first be explored.

COMMERCE and INDUSTRY

Post-War Industrial Research. "Telling the Workers."

Centralisation of Research

A REPORT on scientific industrial research has been prepared by a special committee appointed last June by the London Chamber of Commerce. It reviews the present position with regard to research and considers that there should be planned direction through a Central Research Board; more money devoted to research; and a larger, better-trained and better-paid personnel.

The Board would encourage private firms (in return for grants) to make generally known discoveries which they do not feel it necessary to retain for their exclusive use and to complete investigations which they might possibly abandon as being too remote from their own problems although of use to other industries. It would require research associations to undertake fundamental research in directions which it judged to be in the national interest.

It is recommended to employers that the salaries offered to scientists should be "upgraded" as should those paid to men employed by research associations and universities. The Committee feels that the additional £100,000 which it is prepared to spend on technical education is inadequate. Research is a matter in which the public should be encouraged to take an interest and even to participate in.

Philips Red Cross Ball

On January 21st the Victoria Rooms, the largest ballroom in Bristol, was crowded to capacity with people connected with the electrical and allied trades, and their friends, for the Philips Red Cross Ball. The controlling of this large crowd was efficiently carried out, which was without question one of the main reasons why everybody had such an enjoyable time. Several "spot" dances were arranged, for which suitable prizes were awarded, and there were competitions for port, fruit, eggs, and cycle lighting equipment. Two military bands provided excellent dance music. Judging from the comment as crowds were leaving, the event was one of the most successful dances held in Bristol this year. It is hoped that when all items of expenditure have been settled a cheque in the neighbourhood of £70 will be available for the Red Cross and St. John Prisoners of War Fund.

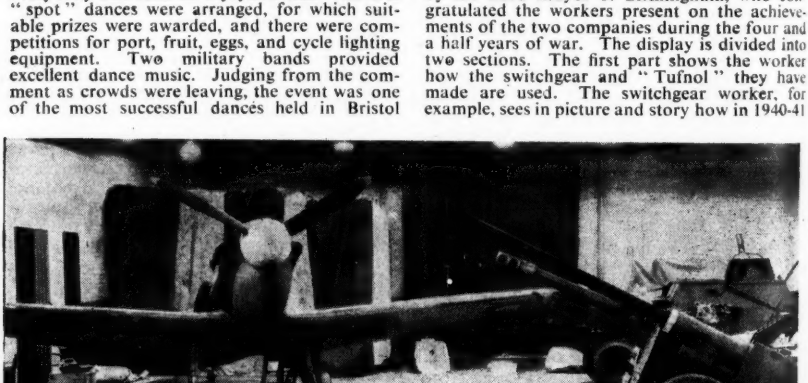
District Heating

Addressing the Liverpool Branch of the Electrical Association for Women last week, Alderman A. E. Shennan referred to the possibility of the Corporation supplying steam heating from central power stations. He said that it was his intention at an early date to ask the new city electrical engineer (Mr. J. Eccles), the city architect and the city engineer to submit a joint report on such a scheme for a commercial centre. He himself thought that it would be quite practicable to draw steam heating for the proposed new central area from a source somewhere on the river front.

Ellison Exhibition

Until February 6th the workers of George Ellison, Ltd., and Ellison Insulations, Ltd., will have an opportunity of seeing how the work they are doing is a vital part of the war effort. The display is sponsored by the Ministry of Supply and supported by other Ministries and Government Departments. Those in the factory of Ellison Insulations know that "Tufnol" parts are required for tanks, aircraft, guns and ships. Few workers, however, know the ultimate use of the particular parts they make. Ellison switchgear is equally vital to the war effort, but those who make it are doing the same job as they did in peacetime and it is difficult for them to realise that their work is one of the keys to the production of weapons.

The exhibition was opened on January 21st by the Lord Mayor of Birmingham, who congratulated the workers present on the achievements of the two companies during the four and a half years of war. The display is divided into two sections. The first part shows the worker how the switchgear and "Tufnol" they have made are used. The switchgear worker, for example, sees in picture and story how in 1940-41



A corner of the Ellison Exhibition

he made switchgear to get the basic industries of coal, iron, chemicals, machine tools and shipbuilding, on to a war footing. He is then shown how switchgear is needed to control the motors of drills, lathes, presses and millers making and shaping the tanks, guns and ships. The "Tufnol" worker sees how the small part he made has been used in a field telephone, how the pulley he made has its place in an aeroplane or the gear he made is used in a pump in a ship.

The second part of the exhibition is devoted to all kinds of weapons of war and this section includes a Spitfire, anti-aircraft guns, a "block buster," a parachutist's folding motor cycle, field guns, armoured fighting vehicles and small arms.

Requests for Catalogues

Firms who produce articles and parts strictly for the electrical trade cannot be expected to supply their catalogues to the public. Therefore those members of the trade who require catalogues should always apply for them on their business notepaper or give some other indication of their status. The matter has recently been brought to our attention by Metway Electrical Industries, Ltd., who have had a number of requests for catalogues from people of whose standing they have been unable to judge.

Scottish Building Centre

Col. G. Gardner McLean, presiding at the sixth annual general meeting of the Scottish Building Centre held in Glasgow on January 25th, said there had been continued progress and there had been an increase in the number of regular users of the Centre's services. Many of the inquiries handled concerned wartime problems, but there was an increasing number relating to post-war materials, equipment, methods of construction, etc.

There was no doubt, particularly in view of the new materials and new methods being developed for use in post-war building, that the Centre was a vital and necessary link in the building industry.

Machines for Plastics Industry

An association has been formed by T. H. & J. Daniels, Ltd., Stroud, Francis Shaw & Co., Ltd., Manchester, and Alfred Herbert, Ltd., Coventry, for the development, manufacture and sale of a comprehensive range of machines and equipment for the plastics industry. By arrangement with the Reed-Prentice Corporation of Worcester, Mass., U.S.A., the complete range of their injection moulding machines will be made in this country by the new association. A full range of die and mould-making plant will be offered.

Fine Reduced

A fine of £100 imposed in Stirling Sheriff Court on W. & W. A. Henderson, Ltd., Airthrey Paper Mills, Bridge of Allan, in respect of a contravention of the Factories Act, 1937, has been reduced by the Justiciary Appeal Court at Edinburgh to a fine of £50. The offence to which the firm pleaded guilty was that of failing securely to fence a turbine extension shaft in the generator house. As a result of coming into contact with the shaft a workman was injured. In reducing the fine, their Lordships took the view that the Sheriff Substitute, who imposed the penalty, wrongly took into consideration the fact that under the Act the whole or part of the fine might be applied to the benefit of the person injured or his family, or otherwise as the Secretary of State determined.

Electricity in the Home

Electricity as a means of raising the standard of post-war homes is the subject of a number of effective window displays at the Magnet

G.E.C. window display at Magnet House

House, Kingsway, premises of the General Electric Co., Ltd. They depict the use of labour-saving devices in the kitchen, with electric heating and radio in the drawing-room for leisure hours.

Arc-Welding Instruction

Lancashire Education Committee reports that at the present time training of persons in arc welding is of considerable importance and there is accommodation in the welding department of the Storey Institute, Lancaster, for this purpose. It is proposed to purchase a transformer set and an AC/DC motor generator set with accessories at a cost of £300 and other equipment at a cost of £250.

"Electrical Review" Index

Copies of the index to Vol. CXXXIII (June–December, 1943) are now available to readers who desire them for binding purposes. Application should be made to the Publisher, *Electrical Review*, Dorset House, Stamford Street, S.E.1.

Radio in War

A lecture on "Radio as an Implement of War" was given to the A.T.C. and members of the Home Guard, Sea Cadets and Civil Defence personnel, by Mr. H. de A. Donisthorpe of the General Electric Co., Ltd., at Newbury, Berks, on January 21st.

The meeting was presided over by the officer commanding the Newbury branch of the A.T.C., Major Tempest, D.S.O., who was responsible for bringing down the second Zeppelin at Potters Bar in the last war. Wireless direction

finding played a prominent part on that occasion, and in his address Mr. Donisthorpe explained how it was employed to find the positions of the raiding Zeppelins and thus successfully bring about their destruction. Mr. Donisthorpe made full use of lantern slides, and carried out a number of experiments and demonstrations.

Electricity for Aerodromes

The Aeronautical Correspondent of *The Times* says that there are now 250,000 acres of airfields in Great Britain. Vast quantities of materials of all kinds have been used in their construction and equipment, including about 7,000 electric transformers, 9,800 switchboards and 336,000 miles of cables.

Bridge Voltage Regulators

Most voltage regulators described in recent years, especially the thermionic valve types, are restricted in their application to the regulation of currents of the order of a few milliamperes. In contrast to them, regulators with barretters or electronic semi-conductors forming one or more of the arms of a "bridge" circuit are capable of delivering DC or AC of any magnitude with the added advantage of not appreciably deteriorating in long service. The principles of their design are discussed in the *Journal of Scientific Instruments* by Mr. C. Morton (Chelsea Polytechnic) who has investigated the conditions necessary for maximum efficiency of regulation combined with economy of power expenditure. The efficiency of regulation may be considerably improved by connecting two or more "bridges" in series.

Combating Smoke

A report on its eleventh annual conference, which was held in London on November 5th, 1943, has been issued by the National Smoke Abatement Society, (1s. net). The proceedings related to smoke prevention in connection with plans for post-war reconstruction. Resolutions to be submitted to Ministries and local authorities included one in favour of extended electrification of main-line and suburban railways and of public service and other vehicles and another recommending the establishment of smokeless zones in towns.

Power Plant Performance

Five-Year Study in Abnormal Conditions

THE performance of a group of generating stations over a five-year period, during which the loading conditions were considerably above normal, is reviewed by Messrs. R. W. Biles and G. W. Maxfield (Central Electricity Board) in a paper submitted to the Institution of Electrical Engineers.

Coal qualities and thermal efficiency are commented on, and an analysis is included of the different classes of breakdown, which permits deductions to be made as to the probable operating life between breakdowns, plant availability and the effects of loading. During the last three years of the period under review the installation of new generating plant did not keep pace with requirements, so that existing plant had to generate at much higher load factors.

It was the difficulties arising therefrom that prompted the authors specially to study operating records of stations separated into appropriate groups so that the three sets of data enabled curves of maximum probable availability to be deduced. From them it is concluded that pre-1930 plant should not be operated at above 45 per cent. average running plant load factor, if good availability is to be consistently maintained, while marked improvement is noted in the availability of the most recent plant installed since 1938 at 80 per cent. average running plant load factor. Good quality and proper grading of fuel are needed, particularly for pre-1930 plant, if maximum output is to be obtained. Greater output between breakdowns has been possible with larger units of plant, but it is not safe to conclude that bigness will generally benefit the industry; the size of unit required is related to load curves and to security needs.

Details of failures are not at present obtainable straightforwardly; the supply industry would benefit from their systematic recording and collection for open discussion and/or publication. Maximum probable availability proposed for each class of plant is a useful guide to the performance that can be achieved and, pending the scrutiny of a wider field, the authors advocate the adoption of the curves they have submitted, which are representative of actual performance. Maximum probable efficiencies, determinable by the methods they describe, can be uniformly applied.

Making calculated operation efficiencies more prominent in station records would benefit all concerned. The figures should be obtained after due allowances have been made for varying running conditions. The authors do not consider that any adjustments are worth while, other than those for running plant load factor and banking coal. High availability of plant ranks first in importance, for it entails correspondingly greater total gain in operating efficiency.

The overall performance of a station can be judged by reference to its availability and operating efficiency. The authors believe there is good ground for their suggestion that these two factors should be combined to form a "standard of merit" which would enable the performances of all classes of stations to be duly recognised.

Electricity Supply Work

Guidance for Young Engineers

At a meeting of the Midland Section of the Junior Institution of Engineers on Wednesday Mr. F. W. Lawton, who has just become engineer and manager of the Birmingham Electric Supply Department, read a paper upon "The Development and Administration of a Large Electric Supply Undertaking." The author's purpose was to assist the university graduate to decide for himself whether a career in the electricity supply industry would enable him to use to the fullest extent his technical training and inherent natural abilities.

No better example of the inception and growth of an undertaking than Birmingham could have been chosen, and Mr. Lawton traced stage by stage the developments which were begun by the Birmingham Electric Supply Co. in 1889, when 11 lb. of coal was consumed to generate one unit. He mentioned among the "high spots" the opening of the Nechells and Hams Hall stations.

Having described the improvements in generating methods throughout this period, Mr. Lawton proceeded to deal in some detail with the ways in which high operating efficiency was attained. Indications given by Willans lines were used to show that one fully-loaded machine ran at a greater efficiency than several operating under fluctuating conditions. The importance of improving the shape of the daily load curve was stressed and Mr. Lawton pointed out that experience, technical knowledge and alertness were required to ensure the proper sharing of load between machines and stations to give the best results. Uniformity of design and lay-out assisted operating economy.

The Boiler House

In a consideration of boiler combustion conditions, the author mentioned the advantages of pulverised fuel where a large variety of coals was to be burnt, although it complicated the ash-disposal arrangements.

Progress in switchgear and control apparatus was referred to. The latest type of control board enabled the control engineer to see all that was happening with his circuits and in the boiler house and turbine room. This section of the paper concluded with a reference to the building department, which was usually necessary in a large undertaking, and to the plant repairs workshop.

In the distribution department a competent drawing office staff planned mains extensions and accurately recorded on plans the positions of all cables. Transformer sub-stations in industrial areas were of standard design but there were occasions when they were required to conform to their surroundings. Mr. Lawton briefly described typical forms of sub-stations.

The size of the Birmingham area necessitated its division into areas controlled by district engineers who maintained close contact with the consumers; this was particularly the case in the rural areas. Cable-laying and pressure testing were briefly touched upon; 53 per cent. of probable faults had been detected by routine methods since the introduction of pressure testing.

Mr. F. W. Lawton

Small firms appreciated the repair service for hired motors. In the domestic repair shops valuable experience was gained on the suitability of appliances and design defects were revealed for correction in later designs. Meter accuracy was essential; an inaccuracy of 1 per cent. in all the Birmingham meters would mean a loss of about £40,000 a year.

Mr. Lawton then turned to the economics of power production, showing that the responsible engineer must arrive at a compromise between continuity of supply and the cost of production. It was seen that coal conservation was sometimes gained only by excessive expenditure. By means of slides the author illustrated the relative financial importance of each section of a power station. Cooling tower equipment represented 8·3 per cent. of the total cost of the station, equivalent to the total charges on twenty miles of h.v. transmission line. Consequently a riverside station was economical only if it was within twenty miles of a load centre. A cooling-tower station required only 1 gal. per kWh hour of make-up water; direct river cooling needed 50 gal. per kWh. Such considerations as these settled the site of a power station.

The siting of a station was a financial and physical determination which left no room for personal opinion when all the facts were available. It was therefore necessary to calculate the cost of production at the busbars and of distribution to the consumers' terminals before final decisions as to site or design could be made. Low load factor did not justify the extra expenditure on high-efficiency plants. While, generally, the larger power stations were the more efficient this was not always true. The economic value of showrooms was not proven; they were rather

a form of service and convenience for the public.

Administration of a large undertaking was complex and called for principal officers of outstanding ability. The chief technical officers should not be too rigidly specialist for this prevented intelligent co-operation and understanding with other specialists. Every act of the engineer could be financially valued and assessed and two-thirds of the total revenue of the undertaking was controlled by pure engineering.

Mr. Lawton showed that the capital cost of generation and that of distribution were fairly evenly balanced. The total capital cost of a generating station was of the order of £20 per kW installed; the boiler house equipment represented 29·5 per cent. and the turbo-alternators 20·3 per cent. Building and civil engineering works amounted to 15·8 per cent., while the purely electrical works represented only 11·7 per cent. of the total cost. The preparatory costs of a new station were considerable.

High stand-by losses could have a marked influence on overall efficiency and production costs. They could be due to faulty operation or to operators running plant unnecessarily, indicating lack of courage or technical ability. Technical operating statistics enabled skilled operators to compare actual operation with designed performance and revealed defects in operation. Financial statistics were necessary to analyse the efficiency of working of any department.

The high expenditure on coal necessitated the employment of skilled staff for the sampling and analysis of the many types of coal received and the carriage of coal also called for the services of a transport officer to ensure a smooth flow.

Qualifications of a Chief Engineer

The chief engineer of a large electricity undertaking had to possess many qualities. He should have a keen and accurate appreciation of human nature and a wide knowledge of finance. The purely technical engineer was reluctant to realise that most technical problems could be referred to economics for final solution or choice. Finance often over-rode technical considerations and financial analysis was simply a measure of economy of effort and capital. The manager encountered problems from the consumers, the staff and trade unions; the general solution to these was consistent fair play.

Next Mr. Lawton turned to the training of personnel. He stressed the complex nature of a modern power station and the need for care and intelligent control, particularly in the boiler house and control room. In the instrument department accuracy and care were called for. Fuel testing was an essential though monotonous service. There was ample scope for the research worker in the chemical and physical laboratory and only fully-trained engineers were now admitted to the drawing office. Power station design was different from plant design and could not be left to the several contractors who supplied the individual units of plant.

A university-trained man would be content only to occupy permanently one of the higher posts but such a man should have no difficulty in reaching this.

The author then remarked upon the architecture of some leading modern power stations and concluded by saying that electricity supply engineering was worthy of the highest type of mentality, men who were fearless and would use their hard-won abilities for greater achievements than those of their ancestors.

Conjoint Conference

Electricity and Gas Competition

AT the annual meeting of the Conjoint Conference of Public Utility Associations on January 26th, Lord Falmouth devoted much of his presidential address to the coal position. In particular, he criticised the refusal by the Government to consult consumers in any shape or form prior to making increases in or adjustments to coal prices.

Turning to the question of competition between the fuel industries, Lord Falmouth said: "I have always been an advocate of co-operation between gas and electricity. I do not, however, plead for any hide-bound form of co-operation such as would lead to the total elimination of competition and the stifling of initiative; that way stagnation lies."

Rivalry between gas and electricity, he continued, should be friendly and restrained, and not of the cut-throat type which would ultimately harm the interest not only of consumers, but of the two industries themselves; it should not so operate as to deny consumers their complete freedom of choice; and, in the national interest, it should never be allowed to obstruct the most efficient use of the nation's coal.

The Conference re-elected Lord Falmouth president for the coming year, and Lord Pentland and Sir David Milne-Watson were elected vice-presidents representing respectively electricity and gas. A third vice-president was to be nominated by the water interests at a subsequent date.

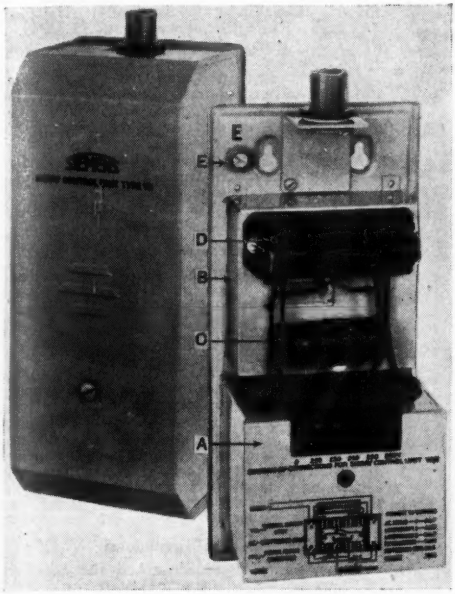
At a subsequent meeting of the new Council Mr. A. E. Sylvester, F.C.A., managing director of the Gas Light & Coke Co., was elected chairman. Mr. Sylvester stressed the necessity for unity in the coming year, a year which would give rise to issues of great importance affecting each of the public services—gas, water, electricity, tramways and hydraulic power—represented on the Council. They had a common and mutual interest which needed to be safeguarded and the Conference was a valuable means to this end. Lieut.-Col. S. S. Ogilvie, D.S.O., and Mr. L. W. F. Millis were re-appointed joint honorary secretaries to the Conference.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Fluorescent Lamp Control Unit

THE latest control unit (Y6-type) for 80-W fluorescent " Sieray " tubular lamps to be announced by SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38, Upper Thames Street, London, E.C.4 (list 981), is now made quite self-contained. All the component parts are assembled in a sheet-steel housing and the internal wiring is completed ready for installation, whereas loose parts were formerly supplied separately for the lamp user to put together.



Control unit for " Sieray " fluorescent lamp

On a pressed steel base is mounted a choke coil (A) with the wiring circuit clearly marked on its sheet metal case. It is compact for its rating, being totally enclosed with compound filling to exclude damp and dust; two ranges are provided for, 190 to 230 V and 220 to 260 V, both in 10 V steps. Next to it is a flat slide-in condenser (B) of 8 μF for power factor correction, which is held in its casing by a leaf spring.

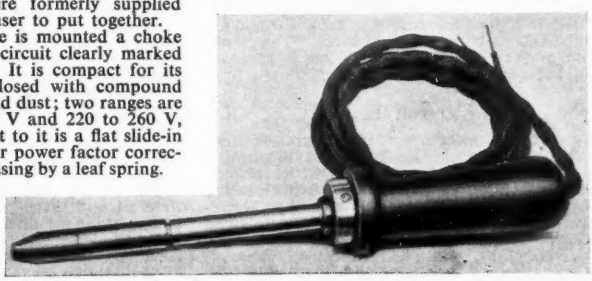
Clipped on top is another condenser (C) for suppressing radiated interference, next to the screw-on terminal block (D) which also forms the socket into which the thermal starter switch is plugged. The latter is thus easily removable and mechanically protected by enclosure in a moulded housing, the four contact pins being so aligned as to make it impossible for the switch to be inserted in the wrong position. The sheet-steel cover of pleasing contour is secured by a single stud with provision for earthing (E) and alternative conduit or cable entry through the end or base plate. The component is suitable for wall mounting or fixing on top of the lamp reflector trough, its dimensions being $10\frac{1}{4}$ by $4\frac{1}{8}$ by $3\frac{7}{8}$ in. high.

Miniature Soldering Iron

When faced with a need for a soldering iron for delicate work the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester 17, developed a miniature model which has been so successful as to justify its manufacture on a commercial basis.

This " Lo-Volt " iron weighs only $3\frac{1}{2}$ ounces, being $8\frac{1}{4}$ in. long overall; it functions normally at 10 V and is therefore quite safe to handle under all conditions. Its makers state that for wartime solders the most satisfactory idle-bit temperatures are between 290 and 360 deg. C. They are accordingly obtained by loadings of 25 to 36 W, the choice depending upon the nature of the work to be done, but it is advisable to have a standby loading of 16 W to keep the iron hot during idle periods. The appropriate voltages are 8, 10 and 12 V, which are obtained from a step-down transformer. Tappings off the secondary winding are brought out to a series of sockets at each operator's stand so that the particular voltage for the job in hand can be chosen for the iron. Alternatively, if necessary, these plugging jacks could be connected to the appropriate number of cells of a battery of accumulators.

The iron has a copper tip that is replaceable. The heating element is tubular, consisting of a helical coil of nickel-chrome wire tightly em-



" Lo-Volt " soldering iron

bedded, by a special process, in crystalline magnesium, the whole being enclosed solidly in a non-scaling copper tube $\frac{1}{8}$ in. in diameter. This construction ensures that the coil is held concentrically in the bore, thereby leaving a uniform thickness of insulation from the copper sheath. The current returns through the steel shank, for which reason polarised type plugs and sockets are used so that the iron can be earthed, though the flexible leads are of only two-core type.

New Control Box

A control-box recently developed by A. REYROLLE & Co., LTD., Hebburn-on-Tyne, for the remote closing and tripping of a spring-operated circuit-breaker can also be arranged to indicate the position ("on" or "off") of the circuit-breaker, and whether the spring is charged. It is necessary to charge the spring by hand at the circuit-breaker in the usual way,

Control box for spring-operated switchgear

but all other control is exercised from the box, which can be applied to spring-operated switchgear of any type. The various indicating lamps, push-buttons, and so on are clearly marked with labels on the hinged door. The gland is self-sealing, and is suitable for making off a cable having up to 30 cores. The gland-end of the main casting is dished to enable a p.i. cable to be sealed off with compound.

Electron Beams

A JOINT meeting of the North Western Branch of the Institution of Electronics and the Manchester and District Branch of the Institute of Physics will be held at the Reynolds Hall, College of Technology, Manchester, at 7 p.m. on Friday, April 14th. The subject of the lecture, by Dr. Dennis Gabor (B.T.H. Co.), will be "Electron Beams." Application for tickets of admission should be made to the hon. secretary, Mr. L. F. Berry, 14, Heywood Avenue, Austerlands, Oldham.

Parliamentary News

Supply from the Grid

IN the House of Commons on January 25th Mr. Higgs asked the Minister of Fuel and Power what was the approximate percentage of the area of Great Britain which had no public supply of electricity from the grid.

Major Lloyd George said that the only district in Great Britain in which the Central Electricity Board, the owner of the grid, did not operate was the North of Scotland, which was covered by the provisions of the Hydro-Electric Development (Scotland) Act, 1943. The area of this district was about 23 per cent. of Great Britain and its population about $1\frac{1}{2}$ per cent. Inside the grid area, however, there were numerous small rural districts which did not receive a public supply. The proportion of the population at present within the area of public supply of electricity was certainly in excess of 90 per cent.

Mr. Higgs asked if the Minister intended to take any action to give a supply to outlying districts at a reasonable price.

Major Lloyd George replied that that was one of the things he was engaged upon.

Increased Ash

Mr. Liddall asked the Minister of Fuel and Power why, whereas prior to the war, the residue from 100 wagons of coal used by an electric power station was ten wagons of ash, to-day from a like supply the residue was thirty wagons of ash.

Major Lloyd George said that owing to the great increase in the load and to the heavy demands for coal for all purposes, it had been necessary to widen the range of fuels supplied to electricity undertakings, and they had co-operated with his Ministry in absorbing increased tonnages of coals of low grades. The ash content varied, but he could not accept the suggestion that it averaged anything like 30 per cent.

Electrical Breakdown

Rear-Admiral Beamish asked the Secretary of State for War if he would state the circumstances which caused, on December 19th last, an electrical breakdown of many hours over a wide area.

Sir James Grigg said that he much regretted the inconvenience caused by the breakdown. The circumstances had been investigated and he understood the cause was a break in an electric cable at 1 p.m. in the course of normal but intensive training in an area requisitioned by the Army. As soon as the military authorities realised how serious the damage was they ordered firing to cease and every assistance was given to the electricity company's engineers to effect the necessary repairs and the service was restored by the evening.

Wireless Licences

On January 26th, in reply to a question, Mr. Bracken said that if the B.B.C. was to maintain a high standard after the war and keep pace with technical developments the question would inevitably arise whether the existing licence fee of ten shillings a year was adequate. He intended to discuss the matter with the Chancellor of the Exchequer.

ELECTRICITY SUPPLY

Hawick Council's Decision. N.W. Midlands Rebate.

Bexhill.—STREET LIGHTING IMPROVEMENTS.—A five-year programme of extended and improved street lighting is to be prepared.

Croydon.—RATE AID.—The Finance Committee has considered the results of the 1943-44 year's working of the electricity undertaking and recommends the appropriation of £26,000 in aid of the rates.

Hawick.—PURCHASE RIGHTS AND PROGRESS.—Last week we reported the Burgh Council's decision to waive its option to purchase the local electricity undertaking from the Urban Electric Supply Co., Ltd., until 1961. The *Hawick Express* of January 26th contains an editorial on the subject headed "A Good Bargain," in which it is pointed out that the special meeting of the Council was completely unanimous in its decision, despite the political opinions held by some members. Attention is drawn to the fact that the reorganisation of the undertaking will be greatly facilitated by its being a subsidiary of a very large national concern with immense resources, a very highly qualified central staff and experience of developing electricity undertakings in many parts of the country.

The Hawick Order came into force on August 1st, 1899. The supply area is 1·7 sq. miles and there is a population of 17,000 in the area. The supply at present is DC direct from the company's own generating station, but some of the plant, although giving good service, was installed as long ago as 1901. The question of changing over and the obsolescence of the plant is the principal reason for an immediate decision. The Urban Company is a subsidiary of Edmundsons Electricity Corporation, Ltd.

London.—HIRE OF WATER HEATERS.—Bermondsey Electricity Committee reports that applications are being received for the hire of water heaters which, under existing conditions, are fixed free of initial cost, the consumer paying a hiring charge of 3d. per week. Owing to increased costs it is proposed to increase this charge to 4d. (unless the consumer pays the full cost of installing the circuit and fixing the apparatus, in which case it will remain at 3d.). It is pointed out that during the present emergency new domestic installations may be fixed only in cases where, in the opinion of the borough electrical engineer, hardship would otherwise ensue.

STREET LIGHTING PREPARATIONS.—An estimate of £345 for lamps, etc., has been approved by Bermondsey Electricity Committee in order that street lighting may be re-instituted throughout the borough immediately the present restrictions are relaxed.

Morecambe. — PEACE CELEBRATIONS. — The Corporation Illuminations Sub-Committee is to make preparations for a scheme of public illuminations to celebrate the end of the war.

North West Midlands.—REBATE FOR CONSUMERS.—At its meeting on January 26th, the North West Midlands Joint Electricity Authority approved a proposal that a non-recurring rebate should be given to consumers in the Authority's distribution area and to authorised undertakings receiving bulk supplies. The concession in the case of ordinary consumers is a discount of 10 per cent. (in addition to the usual cash discount of 5 per cent.) on the amount of the December quarter's account for electricity only; similar discounts are granted to prepayment and large consumers. The estimated cost of these concessions is about £8,000. The accounts for bulk supplies to authorised undertakings for the calendar year of 1943 are to be reduced by 5 per cent.; the estimated cost of this concession amounts to about £27,000. The Authority also decided to discontinue meter rents in the distribution area, and from the March quarter supplies given through prepayment meters for lighting and domestic power are to be reduced proportionately. No further prepayment meters are to be installed; at the present time there are about 10,000 on circuit.

BLOCK TARIFF.—At its next meeting the Authority is to consider a new block rate for the multi-part tariff, in which a certain number of kWh—according to the size of the dwelling—would be charged at the lighting rate of 5½d., all kWh consumed in excess of this quantity to be charged at the present follow-on rate of ½d. The Authority, of which Mr. F. Favell is chief engineer and manager, was established in 1930, and has a record of successful development.

Northmet Area.—ABOLITION OF MINIMUM CHARGE.—Although the Order recently made by the Minister of Fuel and Power authorises a minimum charge at the reduced rate of 10s. per annum, the Northmet Power Co. has decided to abolish the minimum charge altogether. Accordingly, no minimum charge will be applied to accounts for periods ending on or after February 1st, 1944.

Woking.—EXTENSION OF PURCHASE DATE.—The Electricity Commissioners have made the Woking Electricity (Extension of Purchase Date) Order, 1944, extending for two years the period of six months ended January 29th, 1944, within which the Chertsey and Woking Urban District Councils were entitled to purchase part of the undertaking of the Woking Electric Supply Co., Ltd. A similar Order was made last year extending the purchase date of part of the undertaking by the London and Home Counties Joint Electricity Authority.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have information regarding the makers of the following:—

N.E.S. Co., Ltd.—Motor starting rheostat.
E.T.A. coiling winding machines.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

R. A. Lister & Co., Ltd., report a net profit for the year ended September 30th of £136,839, as compared with £121,007 in the previous year, A sum of £35,000 (£25,000) is transferred to general reserve and £35,790 (£30,000) to contingencies reserve, after allowing for £56,710 provided from surplus taxation reserves. A final ordinary dividend of 5 per cent. and a bonus of 6 per cent. are paid, again making a total distribution of 16 per cent. for the year. The carry-forward is £72,524 (£71,475).

The chairman, in his annual statement, refers to the fact that the general reserve has been raised to £819,235 in order to make additional provision for the post-war transitional period—the contingencies reserve has been brought up to £150,000. Current liability for taxation has increased from £73,955 a year ago to £264,724, because instead of paying part of the tax in advance of the due date the company has purchased tax reserve certificates which are shown among the current assets for £400,000. Considerable provision has thus been made for the future.

J. & E. Hall, Ltd., announce that the profit for the year ended September 30th last amounted to £95,036, as compared with £84,429 for the preceding year, after providing £140,000 (against £100,000) for E.P.T., but before charging £55,000 (against £27,000) for income tax. The dividend is maintained at 10 per cent. and the balance carried forward is raised from £49,068 to £63,104.

The Electrical & Industrial Investment Co., Ltd., has again declared a deferred dividend of 12 per cent. in respect of the past year.

Foster, Yates & Thom, Ltd., are paying an ordinary dividend of 5 per cent., as compared with 6 per cent. last year.

The Coventry Gauge & Tool Co., Ltd., is again to pay a dividend of 7½ per cent. and a bonus of 7½ per cent. for the year ended August 31st last. The net profit amounted to £24,021 (£30,991), after providing for taxation.

The Power Securities Corporation, Ltd., recording a net profit of £52,834 for 1943 (against £50,664), is to maintain its dividend at 6 per cent.

The Traction & General Investment Trust, Ltd., reports a net revenue from 1943 of £30,998 (against £28,713). The final dividend is again 5 per cent., maintaining the year's distribution at 7 per cent.

New Companies

Black & Henderson, Ltd.—Private company. Registered January 19th. Capital, £10,000. Objects: To acquire, hold and deal in patents and inventions relating to electricity, radio, television, etc. Directors: D. M. Black, Batchworth Hill House, Rickmansworth, Herts; S. G. Harpour, 5, The Paragon, London, S.E.3; C. A. Whiting, Alverstone, Winscombe Way, Stanmore, Middlesex; and B. J. Henderson, 270, Maidstone Road, Chatham, Kent. Registered office: 21/7, Lamb's Conduit Street, London, W.C.1.

Dagole & Co., Ltd.—Private company. Registered January 10th. Capital, £1,000. Objects: To carry on the business of mechanical and electrical engineers, etc. Subscribers: A. B. Dale, "Greenworld," Warninglid, Sussex; and J. L. Goldsman, 51, Grove Hall Court, St. John's Wood, N.W. Solicitors: E. G. Scott & Co., 31/2, Broad Street Avenue, London, E.C.2.

Companies' Returns

Mortgages and Charges

Electro Methods, Ltd.—Mortgage on a tool cutter and grinder, dated January 12th, 1944, to secure £343 1s. 4d. and any further advances which may be made. Holders: Swiss Bank Corporation.

English Electric Co., Ltd.—Satisfaction to the extent of £25,550 on November 15th, 1943, of trust deed dated May 1st, 1936, and registered May 12th, 1936, securing 4 per cent. debenture stock.

Bennett Agencies, Ltd.—Particulars filed of two series of debentures for £500 and £4,000 respectively, authorised December 31st, 1943, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amounts being now issued.

Correx Communications Equipment, Ltd.—Assignment of contract moneys, dated January 5th, 1944, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Victoria Instrument Co., Ltd.—Satisfaction in full on April 5th, 1943, of mortgage registered August 29th, 1940. (Notice filed January 21st, 1944.)

Liquidations

Howard Smith (Electrical Engineers), Ltd.—Meetings on March 7th, at 3, Abchurch Yard, London, E.C.4, to receive an account of the winding-up by the liquidator, Mr. J. M. Howard.

Bankruptcies

J. Usher, electrical engineer, 39, Corrance Road, Brixton, London.—First meeting to-day (Friday) and public examination February 22nd, at Bankruptcy Buildings, Carey Street, London, W.C.2.

C. G. Merrison, radio dealer, 61B, Raleigh Street, Walsall, Staffs.—Last day for receiving proofs for dividend February 12th. Trustee, Mr. R. K. Clark, Official Receiver, Somerset House, 37, Temple Street, Birmingham, 2.

H. C. Casselden, trading as Edwards & Son, radio, electrical, etc., dealer, 67, London Road, Brighton.—First dividend of 12s. in the £1 payable on February 15th, at 6-7, Old Steine, Brighton. Trustee, Mr. A. E. Orbell.

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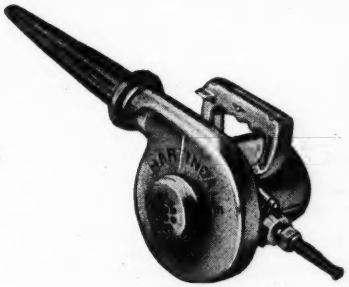

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GD 42

STOCKS AND SHARES

TUESDAY EVENING.

NEWS from the battle fronts continues to monopolise public attention to the extent of causing quiet conditions in Stock Exchange markets where prices, maintaining their ground in the majority of cases, show comparatively little alteration as compared with those at the start of this year. The main factor is the prospect which will open out after the war for any company whose shares are the subject of investment or speculative attention. Amongst the latter group, the shares of companies connected with the radio industry occupy a prominent position. The ordinary shares of manufacturing and equipment companies are particularly well-held in view of their post-war possibilities. A minor feature is the firmness shown by gilt-edged securities, amongst which the prior-charge stocks of the Central Electricity and the London Passenger Transport Boards are included.

Price Fluctuations

More than a score of rises in our price lists this week go against some half-a-dozen falls. No dramatic changes have occurred, but Tube Investments are a florin higher at 96s. and Mather & Platt have gained half-a-crown at 55s. Johnson & Phillips at 69s. have gone up 1s. Henley's are 6d. better at 25s. 6d. General Electrics hold last week's rise at 4½; the 6½ per cent. preference are 6d. up, at 33s. Callender's are better at 5½. Automatic Telephones at 58s. show a gain of 6d. International Combustion fell ½ to 6½ and Electrical Construction eased off to 50s.

The radio group shows no change of consequence. Marconi Marines are better at 33s. Cable & Wireless stocks are both gainers on the week. In the Home electricity supply market, Bournemouth are up 1s. and advances of 6d. each have occurred in the ordinary shares of British Power & Light, County of London, Lancashire Light & Power, and Electric Finance & Securities.

Overseas Affairs

The breaking off of diplomatic relations by Argentina with the Axis powers has put new life into Argentine stocks and shares. Substantial rises in railway stocks were followed by advances in Anglo-Argentine Tramway stocks, the 4 per cent. income rising 2 to £9. Buenos Aires Trams hardened to 38s. On the other hand, Brazilian Tractions gave way to 25½, news of an E.P.T. in Brazil serving to bring in sellers of Brazilian utilities. Canadian lighting and power shares are a firm market, Montreals being 1 higher at 24. International "Tel. & Tel." rose to 15. A strike of workers in the Victoria Falls Power Co., which fizzled out as quickly as it arose, is already almost forgotten; the price of the shares remained at 87s. 6d. throughout the brief disturbance. Indian industrials have added no further to their previous gains.

Preference: For and Against

That there are fashions in finance as well as in feminine frippery is a matter to which notice has been directed on several occasions in these notes. Demand may run so much upon fixed-date securities that irredeemable stocks are relegated to the background. At other times, the position is reversed. Upon occasion, the investor wants ordinary shares: upon the next, preference shares claim his particular attention. Not long ago, a prejudice arose against investment of money in preference shares standing at a high premium. Six per cent. £1 preference shares, for instance, where quoted at about 30s., fell into marked disfavour.

Search for Security

Now, however, the pendulum has swung to the other side. There is no longer any pressure to sell these high-priced preference shares. On the contrary, the amount of capital which comes into the market for employment in pre-ordinary issues, is closely on the look-out for such shares. Investment is to-day willing to give from 30s., to 32s. 6d., for 6 per cent. preference shares the dividend on which is amply covered by earnings. So far from being any fear, as was the case some time ago, of the dividend being reduced on a 6 per cent. preference issue, to-day's buyers deride the possibility of such a thing happening, and, in consequence, they have no compunction in absorbing what shares do occasionally come to market. Security is the chief desideratum in choosing gilt-edged shares for permanent investment. Where capital appreciation is also required, it is to ordinary shares that the prospective buyer turns for possible improvement in price.

Shares on Offer

Brush Electrical Engineering 5½ per cent. preference are obtainable at 24s. 6d. to give 4½ per cent. on the money, with dividends due in April and October. The dividend service, according to the last-published report, was covered some thirteen times over. The company's ordinary shares can be bought at 8s. 9d. returning £4 11s. 3d. on the basis of last year's dividend of 8 per cent. This compared with 6 per cent. in the previous twelvemonth, and nothing at all in 1939 and 1940. The dividend is due in June. Lancashire Dynamo shares pay the not unsatisfactory rate of 4¾ per cent. at the present price of 93s., assuming that the recently-raised dividend of 22½ per cent. is maintained. Dividends are payable in April and October.

(*Continued on page* 175)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Feb. 1	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	62/6	+1/–	4 0 0
British Power and Light	6	7	33/–	+6d.	4 4 10
City of London ..	7	7	28/–	..	5 0 0
Clyde Valley ..	8	8	42/–	..	3 16 0
County of London Edmundsons:	8	8	41/6	+6d.	3 17 0
7% Pref. ..	7	7	34/–	..	4 2 4
Ord.	6	6	29/–	..	4 2 9
Elec.Dis.Yorkshire	9	9	44/–	..	4 1 10
Elec. Fin. and Securities ..	12½	12½	55/–	+6d.	4 11 0
Elec. Supply Corporation ..	10	10	47/–	..	4 5 0
Isle of Thanet ..	Nil	Nil	18/–	..	—
Lancs. Light and Power ..	7½	7½	36/–	+6d.	4 3 4
Llanelly Elec. ..	5½	6	25/–	..	4 16 0
Lond.Assoc.Electric	4	3	24/–	..	2 10 0
London Electric	6	6	28/–	..	4 5 9
LondonPowerRed. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	41/6	..	3 17 0
Midland Counties	8	8	39/6	..	4 1 1
Mid. Elec. Power	9	9	43/–	..	4 3 9
Newcastle Elec.	7	7	31/–	..	4 10 5
North Eastern Elec.: Ordinary ..	7	7	33/–	..	4 4 10
7% Pref. ..	7	7	34/6	..	4 1 2
Northampton ..	10	10	48/–	..	4 3 4
Notting Hill 6% Pref. (£10) ..	6	Nil	11	+¾	—
Northmet Power: Ordinary ..	7	7	38/–	..	3 13 8
6% Pref. ..	6	6	30/3	..	3 18 8
Richmond Elec. .	6	6	26/–	..	4 12 4
Scottish Power ..	8	8	40/–	..	4 0 0
Southern Areas..	5	5	22/6	..	4 9 0
South London ..	7	7	27/–	..	5 3 8
West Devon ..	5	5	23/6	..	4 5 0
West Glos. ..	4½	3½	24/–	..	2 18 4
Yorkshire Elec...	8	8	42/6	..	3 15 3
Overseas Electricity Companies					
Atlas Elec. ..	Nil	Nil	6/6	..	—
Calcutta Elec. ..	7*	6*	38/–	..	3 3 2
Cawnpore Elec...	10	10	35/–	..	5 14 3
East African Power	7	7	33/–	..	4 4 10
Jerusalem Elec...	7	5	28/6	..	3 10 2
Kalgoorlie (10/–)	5	5	10/–	..	5 0 0
Madras Elec. ..	4*	Nil	23/6	..	—
Montreal Power..	1½	1½	24	+1	6 5 0
Palestine Elec."A"	4*	5*	40/3	..	2 9 10
Perak Hydro-elec.	6	7	10/–	..	—
Shawinigan Power	83cts.	90cts.	17	..	—
Tokyo Elec. 6%	6	6	18	..	—
VictoriaFallsPower	15	15	4¾	..	3 8 7
Whitehall Inv.Pref.	—	6	24/–	..	5 0 0

Company	Dividend Previous	Dividend Last	Middle Price Feb. 1	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity: 1955 60 Civil Defence) ..	—	2	100	..	3 0 0
1955–75 ..	5	5	115	..	4 7 0
1051–73 ..	4½	4½	107	..	4 4 1
1963–93 ..	3½	3½	103	..	3 8 0
1974–94 ..	3½	3½	100	..	3 5 0
London Elec.Trans. Ltd.	2½	2½	97	..	2 11 3
London & Home Counties1955–75	4½	4½	112	..	4 0 4
Lond.Pass.Trans.: A	4½	4½	119½	..	3 15 4
B	5	5	119½	..	4 3 8
C	2½	3	66	..	4 11 0
WestMidlandsJ.E.A. 1948–68 ..	5	5	109	..	4 11 9
Telegraph and Telephone					
Anglo-Am. Tel.: Pref.	6	6	116	..	5 3 5
Def.	1½	1½	28xd	..	5 7 2
Anglo-Portuguese	8	8	24/–	..	6 13 4
Cable & Wireless: 5½ Pref. ..	5½	5½	113	+1	4 17 0
Ord.	4	4	79	+½	5 1 3
CanadianMarconi$1	Nil	4cts.	8/6	..	—
Globe Tel.& Tel.: Ord.	8¼*	5*	36/6	–6d.	2 14 9
Pref.	6	6	30/–	..	4 0 0
Great NorthernTel. (£10)	Nil	Nil	22½	..	—
Inter. Tel. & Tel.	Nil	Nil	15	+1	—
Marconi-Marine..	7½	7½	33/–	+9d.	4 11 0
Oriental Tel. Ord.	16	10	44/6	..	—
Telephone Props.	6	Nil	17/6	..	—
Tele.Rentals(5/–)	10	10	11/6	..	4 7 0
Traction and Transport					
Anglo-Arg.Trans.: First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc. ..	Nil	Nil	9	+2	—
Brit.Elec.Traction: Def. Ord. ..	45	45	1085	..	4 2 7
Pref. Ord. ..	8	8	175	..	4 11 5
Bristol Trams ..	10	10	52/6	+6d.	3 16 2
Brazil Traction .	$1	$1⅛	25½	–¾	6 18 7
Calcutta Trams..	5½	6½	37/–	..	3 10 5
Cape Elec. Trams	5	6	24/–	..	5 0 0
Lancs. Transport	10	10	44/3	..	4 10 1
Mexican Light: 1st Bonds ..	5	5	102½	..	4 17 7
Rio 5% Bonds ..	5	5	104½	..	4 15 9
Southern Rly.: 5% Prefd. ..	5	5	77¼	+¼	6 9 0
5% Pref. ..	5	5	118½	+½	4 4 5
T. Tilling ..	10	10	55/6	+6d.	3 12 0
West Riding ..	10	10	44/6	+6d.	4 10 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Feb. 1	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord. ..	10	15	55/–	..	5 9 1
Assoc. Elec. :					
Ord.	10	10	50/6	..	3 19 0
Pref.	8	8	38/6	..	4 3 1
Automatic Tel. & Tel.	12½	12½	58/–	+6d.	4 6 2
Babcock & Wilcox	11	11	50/–	..	4 8 0
British Aluminium	10	10	48/–	+3d.	4 3 4
British Insul. Ord.	20	20	5½	–⅛	3 14 4
British Thermostat (5/–)	18½	18½	19/–	..	4 17 4
British Vac. Cleaner (5/–)	15	30	27/6	..	5 9 1
Brush Ord. (5/–) ..	6	8	8/6	..	4 14 2
Burco (5/–) ..	15	17½	15/3	..	5 14 9
Callender's ..	15	20	102/6	+6d.	3 18 2
Chloride Elec. Storage	15	15	80/–	..	3 15 0
Cole, E. K. (5/–)	10	15	26/–	..	2 17 10
Consolidated Signal	17	24	6	..	4 0 0
Cossor, A. C. (5/–)	7½*	10*	22/–	..	2 5 6
Crabtree (10/–) ..	17½	17½	38/3	+1/–	4 11 5
Crompton Parkinson Ord. (5/–) ..	20	22½	27/–	..	4 3 4
E.M.I. (10/–) ..	6	8	27/6	..	2 17 2
Elec. Construction	10	12½	50/–	–6d.	5 0 0
Enfield Cable Ord.	12½	12½	59/–	+6d.	4 4 8
British Electric .	10	10	49/–	..	4 1 6
Ensign Lamps (5/–)	25	15	20/–	..	3 15 0
Ericsson Tel. (5/–)	22*	20*	51/3	..	1 19 0
Ever Ready (5/–)	40	40	39/–	..	5 2 7
Falk Stadelmann	7½	7½	32/6	..	4 12 4
Ferranti Pref. ..	7	7	29/6	..	4 15 0
G.E.C. :					
Pref.	6½	6½	33/–	+6d.	3 18 9
Ord.	17½	17½	90/–	..	3 17 9
Greenwood & Batley	15	15	41/3	..	7 5 9
Hall Telephone (10/–)	12½	12½	25/6	..	4 18 1
Henley's (5/–) ..	20	20	25/6	+6d.	3 18 8
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	17½	60/–	..	5 16 8
India Rubber Pref.	5½	5½	21/6	..	5 2 4
Intl. Combustion	30	30	6¼	–¼	4 18 0
Johnson & Phillips	15	15	69/–	+1/–	4 7 0
Lancashire Dynamo	20	22½	92/–	..	4 18 6
Laurence, Scott (5/–)	12½	12½	13/–	..	4 16 2
London Elec. Wire	7½	7½	34/6	..	4 7 0
Mather & Platt ..	10	10	55/–	+¼	3 12 9
Metal Industries (B)	5	8	44/3	..	3 12 2
Met. Elec. Cable Pref.	5½	5½	21/3	..	5 3 6
Murex	20	20	100/–	..	4 0 0
Pye Deferred (5/–)	25	25	26/3	..	4 15 3
Revo (10/–) ..	17½	17½	38/6	..	4 11 0
Reyrolle ..	12½	12½	68/9	..	3 12 8
Siemens Ord. ..	7½	7½	33/–	..	4 11 0
Strand Elec. (5/–)	7½	10	7/9	..	6 9 0
Switchgear & Cowans (5/–) ..	10	20	18/–	..	5 11 1
T.C.C. (10/–) ..	5	5	18/9	..	2 13 4
T.C. & M. ..	10	10	50/6	..	3 19 2
Telephone Mfg. (5/–)	9	9	11/–	..	4 1 10
Thorn Elec. (5/–)	20	20	22/3	..	4 11 0
Tube Investments	20	20	96/–	+2/–	4 3 4
Vactric (5/–) ..	Nil	Nil	13/6	–6d.	—
Veritys (5/–) ..	7½	7½	7/3	..	5 3 5
Vickers (10/–) ..	10	10	17/6	..	5 14 3
Walsall Conduits (4/–)	55	55	44/6	..	4 18 9
Ward & Goldstone (5/–)	20	20	27/3	..	3 13 5
Westinghouse Brake	12½	14	70/–	..	4 0 0
West, Allen (5/–)	7½	7½	6/9	..	5 11 2

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 173)

Westinghouse Brake ordinary give practically 4 per cent. and English Electric ordinary, of which there are 1,000 on offer at 50s. 6d., return at that price £3 19s. 3d. This latter is 2s. 6d. per cent. more than the yield on General Electrics at 91s. Associated Electrical Industries ordinary shares at 51s. 6d. pay £3 17s. 6d. per cent.

From these examples it will be noticed that what are called the "blue chip" investments in the industrial market yield barely 4 per cent. on the money.

Notting Hill Company

After standing at about the par value of £10 for some time past, the price of Notting Hill Electric 6 per cent. cumulative preference shares has risen to 11. This is a more or less nominal quotation because there are few shares, if any, on offer in the market, where anticipation looks for a possible clearing-off of the arrears of dividend that have accumulated since the last payment on July 1st, 1939. This means that there is now 4½ years of dividend accrued in the price, equal to 27s. per share, taking income tax at 10s. in the £. The ordinary shares are all held by the Metropolitan Electric Supply Co. For some years, the Notting Hill Co. did very well, paying dividends on its ordinary shares of 10 per cent. for 1932, 11 per cent. for each of the three following years and 8 per cent. in 1936 and 1937. The dividend fell to 5 per cent. in 1938 and the ordinary have received nothing since then. The company owns the right to supply electricity for all purposes over an area of about two square miles in certain portions of Kensington.

Crabtree Electrical

Crabtree Electrical Industries shares are better at 38s. 3d., the yield of £4 14s. per cent. inviting notice. The company was registered in November, 1936, and has paid dividends of 17½ per cent. annually. Of this, 7½ per cent. has been announced as bonus. The year ends on October 31st. Trading profits have gone ahead substantially since 1937, but net profits have been severely bitten into by taxation. The company holds all the issued share capital of J. A. Crabtree & Co., Ltd., which was formed twenty-five years ago to manufacture switches and other electrical accessories.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

AJAX Manufacturing Co.—" Wire drawing machines and method." 17736/43. September 16th, 1941. (Divided out of 558495.) (558613.)

Akt.-Ges. Brown, Boveri & Cie. " Electrical transformers." 10994/41. November 23rd, 1940. (558648.)

Aron Electricity Meter Co., Ltd., and E. J. Riordan.—" Course and speed calculating apparatus for use with aeroplanes." 9705. July 13th, 1942. (558685.)

Arrow Electric Switches, Ltd.—" Electric circuit-breakers having automatic tripping means." 488/43. January 13th, 1942. (558579.)

British Thomson-Houston Co., Ltd.—" Electric-discharge lamps." 9393/42. July 11th, 1941. (558565.) " Electric gas-blast circuit-breakers." 8142/42. June 17th, 1941. (558668.) " Synthetic resinous moulding compositions." 554/42. January 16th, 1941. (558652.) " Production of modified phenolaldehyde resinous condensates and compositions comprising said condensates." 4992/42. April 17th, 1941. (558654.) "Resinous compositions." 5903/42. May 2nd, 1941. (558656.)

Bruno Patents, Inc.—" Combined pipe coupling and electric connecting device." Cognate applications 9354/42 and 9355/42. September 3rd, 1941. (558705.)

C. R. Burch and Metropolitan-Vickers Electrical Co., Ltd.—" Lenses." 6282. May 8th, 1942. (558657.)

English Electric Co., Ltd., A. R. Blandford, and F. G. Rowland.—" Electric circuit-breakers of the gas-blast type." 4504. April 3rd, 1942. (558559.)

Ford Motor Co., Ltd.—" Electrical apparatus and method of construction thereof." 18613/43. March 14th, 1941. (Divided out of 558222.) (558678.)

H. H. Goldstaub.—" Electrically heated garments." 9595. July 10th, 1942. (558630.)

Graviner Manufacturing Co., Ltd., and A. Mathisen.—" Electrically actuated fire preventing and extinguishing systems for use upon aircraft." 9491. July 8th, 1942. (558592.)

B. Harris.—" Method of supporting and locating wires of electrical circuits." 9480. July 8th, 1942. (558591.)

A. H. Hunt, Ltd., and E. Reinhardt.—" Means for adjusting the capacity of electrical condensers." 11537. August 17th, 1942. (558693.)

A. H. Hunt, Ltd., R. A. Grouse, and J. Rogers.—" Electrical condensers made from metallised paper." 9729. July 13th, 1942. (558686.) " Manufacture of electrical condensers." 9730. July 13th, 1942. (558687.) " Metallised paper electrical condensers." 9731. July 13th, 1942. (558688.)

F. W. Knowles.—" Dry-shaving devices." 14948. October 24th, 1942. (558703.)

Marconi's Wireless Telegraph Co., Ltd.—" Art of mounting piezo-electric crystals." 656/43. June 30th, 1941. (558581).

J. F. O'Brien.—" Feed unit for electric wiring system." 7182/42. June 26th, 1941. (558681.)

Philco Radio & Television Corporation.—" Electro-acoustic transducer." 5893/42. June 13th, 1941. (558680.) " Radio-phonograph combinations." 16610/43. June 13th, 1941. (Divided out of 558680.) (558704.)

Rediffusion, Ltd., and P. Adorjan.—" Electric measuring, indicating, recording or controlling apparatus." 5892. May 1st, 1942. (558614.) Also 19867-9/43. (Divided out of 558614.) (558645-7.)

Standard Telephones & Cables, Ltd.—" Synchronising generators." 379/43. January 14th, 1942. (558578.)

Standard Telephones & Cables, Ltd., and G. L. Ward.—" Electrode soldering irons." 9608. July 10th, 1942. (558634.) " Electric soldering apparatus." 10731. July 31st, 1942. (558643.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and C. T. Scully.—" Thermionic amplifiers." 9541. July 9th, 1942. (558597.) " Thermionic valve receiving circuits." 9543. July 9th, 1942. (558598.) " Thermionic valve circuits." 9603. July 10th, 1942. (558632.)

A. H. Stevens (Electronic Laboratories, Inc.).—" Electrical systems, particularly systems for converting direct current into alternating current." 6878. May 20th, 1942. (558658.)

J. Stone & Co., Ltd., and L. R. Nixon.—" Electric regulators of the carbon pile type." 7798. June 8th, 1942. (558622.)

J. Stone & Co., Ltd., A. H. Chilton and L. R. Nixon. " Electric regulators of the carbon pile type." 7797. June 8th, 1942. (558,621.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the following British trade marks. Objections may be entered within a month from January 26th:—

ENCOGAS and ENCOGEN. Nos. 625,635 and 625,637. Class 1. Gases for use as atmospheres in heat-treatment furnaces and chambers. Same. Nos. 625,636 and 625,638. Class 4. Fuel for use in creating atmospheres in heat-treatment furnaces and chambers. (Associated marks.) ENCOGEN. No. 625,639. Class 11. Furnaces and plant for use in the heat treatment of metals; gas generating plant. To be associated with No. 622,846 (3403) xi.—Wild-Barfield Electric Furnaces, Ltd., Elecfurn Works, Watford By-Pass, Watford.

LAMINEX. No. 623,948. Class 9. Electric battery or accumulator jars made of laminated material composed of synthetic-resin impregnated paper, of synthetic-resin impregnated textile material, or of a combination of these two materials.—United Ebonite & Lorival, Ltd., Springside Works, Little Lever, near Bolton.

LILIPUT. No. 624,758. Class 9. Automatic electro-magnetic voltage and current regulators. To be associated with No. 416,919 (2312) (vi).—J. Stone & Co., Ltd., Abinger Road, S.E.8.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Birkenhead.—February 14th. Electricity Department. Supply and delivery of electric lamps over a period of twelve months, commencing April 1st. Specifications and form of tender from the borough electrical engineer, Craven Street, Birkenhead. (See this issue).

Tottenham.—February 11th. Town Council. Lamps (Schedule No. 20). Forms of tender from Mr. E. Townson, town clerk, Town Hall, London, N.15.

Orders Placed

Croydon.—Electricity Committee. Accepted. Complete renewal of positive plates of power station battery (£1,015).—Tudor Accumulator Co.

Herne Bay.—Works Committee. Recommended. Rectifier battery charger.—Runbaken Electrical Products.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Three-apartment houses of hutted type (100); city architect.

Armadale.—Miners' hostel; architect, Ministry of Works, Edinburgh.

Bedlington (Northumberland).—Works canteen; —Hughes, Bolchin, Ltd.

Bolton.—Works extensions, Nelson Street, for Bolton Leathers, Ltd.; G. & J. Seddon, Ltd., builders, Little Hulton.

Additions to Derby Street mills; T. E. Smith & Sons, architects, Central Chambers, Folds Street.

Brechin.—Food depot for school children (500 meals per day); clerk, School Management Committee.

Bury.—Dining room and kitchen, Elton Fold Mill; R. Byrom, architect, Victoria Buildings, Silver Street.

Works extensions; Oliver Ashworth (Bury), Ltd., Castle Grounds.

Works extensions, Back Shaw Street, for F. Bentley (Bury), Ltd.; John Tinline, Ltd., builders, Parker Street Saw Mills.

Coventry.—Extensions to buildings for Markets Committee; D. E. E. Gibson, city architect, 1a, Warwick Row.

Durham.—School kitchens and sculleries: Blackhall, Boldon, Burnhope, Chester-le-Street, Greencroft, Hamsterley, Horden, Station Town and Tudhoe; county architect, 34, Old Elvet, Durham.

Conversion of Homer Villa, Jarrow, into tuberculosis centre; county surveyor.

Enfield.—Canteen, Alexandra Road; J. Henderson & Co.

Fleetwood.—Clinical hospital (£1,000); the governors.

Fraserburgh.—Completion of 13 houses; Burgh Surveyor's Office, 51, Mid Street.

Gateshead-on-Tyne.—Works canteen for the North Eastern Trading Estate; W. & T. A. Milburn, 17, Fawcett Street, Sunderland.

Guildford.—Works additions, Walnut Tree Close; Parker Timber Co.

Jarrow-on-Tyne.—Adaptation of Acca House, Grant Street, as infant school; St. Bede's R.C. School.

King's Lynn.—Nursery (£2,115); R. Saunders & Sons, Ltd., builders, 124, Fonthill Road, Finsbury Park, London, N.4.

Lanarkshire.—Establishment of farm school, Carnwath; county architect, 34, Albert Street, Motherwell.

Lancashire.—Extensions to Junior School, Whitefield; L. Evans, county architect, County Offices, Fishergate Hill, Preston.

Leeds.—Reinstatement of City of Leeds School; W. S. Cameron, city engineer, Civic Hall.

Maidstone.—British restaurant, Lock Meadows; J. H. Hughes, borough surveyor, Palace Avenue.

Manchester.—Additions to hospital and nurses' home, Nell Lane, Withington; G. Noel Hill, city architect, Town Hall, Albert Square.

Middlesbrough.—Workshop and offices, Langlands Road; Dean Brothers, builders.

Middlesex.—Nurseries at Feltham, Friern Barnet and Hayes; county architect.

Morpeth.—Completion of 106 houses at Widdrington; F. Kirby, R.D.C. offices, Morpeth.

Newbury.—Temporary church, St. John's Road; St. John's Church trustees.

Additions, Shaw School (£2,336); borough engineer; additions, Town Mills, for Hovis, Ltd.; Floyd & Robson.

Newcastle-on-Tyne.—Rebuilding of the Dun Cow Inn, Willington; Archibald Arrol & Sons, Ltd.

Extensions to premises for H. Harding & Sons, Ltd., coachbuilders, St. Andrew's Street.

Norden.—Additions to Bamford Woollen Mills, Norden Road; James Berry, Ltd., builders, Chapel Street, Heywood.

Oldham.—Workshops and store, Salem Street; Greenwood & Tyson, builders, 111, Victoria Avenue, Blackley, Manchester, 9.

Pelaw-on-Tyne (Co. Durham).—Office block for Bowran & Co., Ltd.; R. A. Gofton & Son, Front Street, Monkseaton, Whitley Bay.

Perth.—Extensions to maternity wards, Royal Infirmary; R. Adam, town clerk, City Chambers.

Preston.—Bus station; J. E. Foster, borough surveyor, Town Hall.

South Shields (Co. Durham).—Canteen, Westoe Colliery; G. W. Smith, 5, Wansbeck Road, Jarrow-on-Tyne.

Stockport.—School kitchen and dining room, High School for Girls, Cale Green; L. Yates, education architect, Education Offices.

Stretford.—Works extensions; E. Ogden & Partner, architects, 1, Ridgefield, King Street, Manchester, 2.

Sunderland.—New offices at works of North Eastern Fabrication, Ltd.; J. T. Potts & Son, John Street.

Wallsend. — School meals centre, Addison Potter School; J. A. Blench, borough surveyor.

Walsall.—Fire station, police buildings and law courts; M. E. Habershon, borough engineer, The Council House.

Worcestershire.—School kitchen, Alvechurch; H. Rowe & Son, county architects, 38, Foregate Street, Worcester.

York.—Assembly hall; secretary, Village Hall Committee, Holme-on-Spalding Moor, near York.

Five cooking centres for school meals; C. J. Minter, city engineer, Guildhall.

Forthcoming Events

Institution of Electrical Engineers.—*Transmission Section.*—Wednesday, February 9th, 5.30 p.m. "Transmission and Distribution of Electricity to Mines," by Mr. B. L. Metcalf.

Installations Section.—Thursday, February 10th, 5.30 p.m. "Thermoplastic Cables," by Dr. H. Barron, Mr. J. N. Dean and Mr. T. R. Scott, D.F.C.

Wireless Section.—Tuesday, February 15th, 5.30 p.m. Discussion on "Recording and Reproduction of Sound," to be opened by Dr. G. F. Dutton.

Measurements Section.—Friday, February 18th, 5.30 p.m. "A Modern Earth-Fault Relay Equipment for Use on Systems Protected by Petersen Coils," by Messrs. L. B. S. Golds and C. L. Lipman. Joint meeting with Transmission Section.

South Midland Centre.—Monday, February 7th, 6 p.m. James Watt Memorial Institute, Birmingham. "Bonded Deposits on Economiser Heating Surfaces," by Messrs. J. R. Rylands, M.Sc., and J. R. Jenkinson. Members of the Institution of Mechanical Engineers are invited to attend.

Mersey and North Wales (Liverpool) Centre.—Monday, February 7th, 5 p.m. Liverpool Royal Institution, Colquitt Street. "Air-blast Circuit-breakers," by Mr. A. R. Blandford.

Scottish Centre.—Tuesday, February 8th, 6.15 p.m. Societies' Room, Royal Technical College, George Street, Glasgow. "Maintenance of Distribution Plant and Mains on AC Networks," by Messrs. F. N. Beaumont, B.Sc. (Eng.), and F. A. Geary.

North-Eastern Centre.—Monday, February 14th, 6.15 p.m. Neville Hall, Westgate Road, Newcastle-on-Tyne. "University Education and Industrial Training of Telecommunication Engineers," by Prof. Willis Jackson.

North-Eastern Students' Section.—Friday, February 11th, 6.30 p.m. Neville Hall, Westgate Road, Newcastle-on-Tyne. "A Modern Trunk Exchange," by Mr. Morgan.

London Students' Section.—Tuesday, February 8th, 7 p.m. "Recent Progress in Telecommunications Due to the Use of New Materials," by Col. Sir A. Stanley Angwin, D.S.O., M.C., T.D.

Bristol Students' Section.—Friday, February 11th, 7.15 p.m. Merchant Venturers' Technical College, Bristol. Lecture: "Electrical Engineering Research," by Mr. H. W. H. Warren.

North Midland Students' Section.—Saturday, February 12th, 2.30 p.m. Griffin Hotel, Leeds. "Music Channels in Telephone Cables," by Mr. A. C. Holmes.

Junior Institution of Engineers.—Friday, February 18th, 6.15 p.m. 39, Victoria Street, S.W.1. "Industrial Infra-Red Heating," by Mr. A. C. F. Mackadam.

North-Western Section.—Saturday, February 5th, 2.30 p.m. Manchester Geographical Society, 16, St. Mary's Parsonage. Annual meeting.

Institution of Chemical Engineers.—Tuesday, February 8th. "Use of Infra-red Radiation in relation to Distillation and Evaporation Problems," by Mr. J. A. Reavell.

Association of Supervising Electrical Engineers.—Saturday, February 12th, 2.15 p.m. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2. Illustrated lecture on "Remote Control Equipment and Operation," by Mr. A. T. Crawford, B.Sc., A.M.I.E.E.

Association of Mining Electrical and Mechanical Engineers. — *West of Scotland Branch.* — Saturday, February 12th. Discussion on the 1942 annual report of the Electrical Inspector of Mines.

South Wales Branch.—Saturday, February 19th. Crumlin. "Brains Trust." Questions to be sent to the secretary, Mr. J. Vaughan Harries, 19, Rhydhelig Avenue, Cardiff, not later than February 12th.

Illuminating Engineering Society. — *Bath-Bristol Centre.*—Monday, February 7th. Bath. "Foot Candles, Lumens and All That," by Mr. E. J. Ireland.

Derby Society of Engineers.—Monday, February 14th, 6.30 p.m. School of Arts Lecture Theatre, Green Lane. "Plastics," by Mr. M. Apley.

British Institution of Radio Engineers.—*London Section.*—Wednesday, February 16th, 6.30 p.m. Institution of Structural Engineers, 11, Upper Belgrave Street, S.W.1. Discussion on "Television Standards," to be opened by Messrs. L. H. Bedford, O.B.E., and W. A. Beatty.

Women's Engineering Society.—*Manchester Branch.*—Thursday, February 17th, 6,30 p.m. Engineers' Club, Albert Square. "Light and Lamps," by Mr. A. Owen.

Institution of Mechanical Engineers.—Friday, February 18th, 5 p.m. Annual general meeting and paper on "Fencing of Dangerous Parts of Machinery," by Mr. H. A. Hepburn.

Commercial Electric Refrigeration Association.—Wednesday, February 23rd, 1.15 p.m. Connaught Rooms, London, W.C.2. Annual luncheon.